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Serena Maharaj
AUTEUR DE LA THÈSE / AUTHOR OF THESIS

M.Sc. (Biology)
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FACULTÉ, ÉCOLE, DÉPARTEMENT / FACULTY, SCHOOL, DEPARTMENT

Factors Contributing to Elevated Levels of Methyl and Total Mercury Related to Alteration in Wetland Conditions and Agricultural Activity (The Raisin River Watershed)

TITRE DE LA THÈSE / TITLE OF THESIS

Dr. David Lean
DIRECTEUR (DIRECTRICE) DE LA THÈSE / THESIS SUPERVISOR

CO-DIRECTEUR (CO-DIRECTRICE) DE LA THÈSE / THESIS CO-SUPERVISOR

EXAMINATEURS (EXAMINATRICES) DE LA THÈSE / THESIS EXAMINERS

Dr. Jeff Ridal

Dr. Sean Carey

Dr. Jules Blais

Gary W. Slater
Le Doyen de la Faculté des études supérieures et postdoctorales / Dean of the Faculty of Graduate and Postdoctoral Studies

FACTORS CONTRIBUTING TO ELEVATED LEVELS OF METHYL AND TOTAL MERCURY RELATED TO ALTERATION IN WETLAND CONDITIONS AND AGRICULTURAL ACTIVITY (THE RAISIN RIVER WATERSHED)

SERENA P. A. MAHARAJ

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ABSTRACT

Seasonal and spatial patterns of methyl and total mercury and nutrient concentrations were measured during 2005-2007 in the Raisin River, North-west of Cornwall, Ontario, Canada (75°44′ W, 45°08′ S) to determine if inputs from farming activities or altered wetlands (Newington Bog and Monkland Drain) are contributing to the contamination of the River. Water samples were analyzed using atomic fluorescence gas chromatography for methyl mercury; a Tekran 2600 mercury analyzer for total mercury; and a Lachat Nutrient Analyzer 8000 QuikChem for nitrate, ammonia, sulphate, and total phosphorus. Land features from the Ontario Ministry of Natural Resources and local precipitation data from the City of Cornwall were used. Kruskal-Wallis and Spearman statistical analyses were applied. MeHg and THg concentrations in the 5 Divisions of the Raisin River ranged from 0.03-1.02 ng L^{-1} and 0- 7.57 ng L^{-1} respectively. MeHg concentrations in the peatlands were in the range of ~0.10 to 2.29 ng L^{-1}, with the highest observed at the Newington Bog in May 2007. Nutrient concentrations in the Raisin River were high with ammonia ranging to 263 μg L^{-1}, nitrate to 2575 μg L^{-1}, and total phosphorus to 162 μg L^{-1}. The statistical analyses support a seasonal variation of MeHg and THg in the Raisin River, but not a spatial trend for MeHg, for % of THg as MeHg, THg and for the Peatland sites. Significantly positive correlations of MeHg and THg with nutrients exist. Yield data identifies the drained peatland in the headwater regions as the major source of mercury to the river with little, if any, influence of the elevated nutrient levels found along the river. Considerations of the yield data and land features suggest that agricultural activities, including runoffs and inputs from residential/community activities in upstream towns can influence nutrients and mercury levels in water systems.

RÉSUMÉ

Les patrons saisonniers et spatiaux du mercure total et méthyle de mercure furent étudiés dans le bassin versant de la Rivière Raisin de l'Est Ontarien (75°44′ O, 45°08′ S). Cette étude, durant 2005-2007, avait pour but de déterminer si les concentrations élevées provenant des nutriments de l'activités agricoles ou si l'altération des terrains inondés tel que le marécage Newington et les drains de Monkland contribuent à la contamination de l'écosystème. Des échantillons d'eau ont été analysés en utilisant la chromatographie de gaz à fluorescence atomique pour le mercure de méthyle ; un Tekran 2600 analyseur pour le mercure total ; et un l'Analyseur Lachat Nutritif 8000 QuikChem pour le nitrate, l'ammoniaque, le sulfate, et le phosphore total. Les caractéristiques physiques et les données météorologiques des terrains étudiés proviennent du Ministère des Ressources Naturelles de l'Ontario et de la Ville de Cornwall. Les analyses statistiques Kruskal-Wallis et Spearman ont été appliquées. Pour les 5 Divisions de la Rivière Raisin, les concentrations de méthyle de mercure variaient entre 0,03 et 1,02 ng L^{-1}, et celles de mercure total variaient entre 0 et 7,57 ng L^{-1} . Les concentrations de méthyle de mercure dans les marécages variaient entre environ 0,10 et 2,29 ng L^{-1}, avec les concentrations les plus élevées provenant des sites du Marécage Newington en Mai 2007. Les concentrations de nutriments étaient aussi très élevées, avec des concentrations atteignant jusqu'à 263 µg L^{-1}pour l'ammoniaque, 2575 µg L^{-1} pour le nitrate et 162 µg L^{-1} pour le phosphore total. Les analyses statistiques soutiennent qu'il y a des variations avec les saisons pour le méthyle de mercure et le mercure total pour les sites de la rivière Raisin, mais pas de variations spatiales pour le MeHg, le % de THg sous forme de MeHg et pour tourbières. Les corrélations significativement positives de MeHg et THg avec les nutriments existent. Les données de rendement identifient clairement

que les tourbières hydrologiquement altérées (drainées) des régions en amont sont les sources majeures de mercure à la rivière avec peu d'influence, s'il y a lieu, des concentrations nutriments élevés trouvés le long de la rivière. Les données de rendement et le relief du terrain suggèrent que les activités agricoles, notamment la contribution des déchets et produits dérivés parvenant des centres urbains situés en amont des rivières, ont une forte influence sur les niveaux de concentrations de nutriments et mercure dans les systèmes d'eaux.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Rivers are dynamic aquatic systems characterized by unidirectional flow from headwaters to downstream locations (Wetzel, 2001), and can receive inputs from neighboring peatlands. Such aquatic systems are often sources of drinking water and can be used for irrigation of agricultural land. Anthropogenic influences can result in degradation if mitigation strategies are not implemented. It is therefore important to gain knowledge of factors that degrade water to minimize impact on human and animal health and well being.

One pollutant of concern in aquatic systems is mercury. Methyl mercury is one of the most toxic forms of mercury found in the environment; it is biologically active (Berntssen, 2003) and bioaccumulates in food chains (Mason *et al.*, 1996). Most human exposure occurs by consumption of fish high in methyl mercury (above 0.5 μg Hg per gram wet weight (CFIA, 2002)) from both freshwater and marine ecosystems (Niencheski *et al.*, 2001). Methyl mercury in the food chain remains an important human health concern because of its neurotoxicity (Clarkson, 1998).

The Raisin River is a freshwater ecosystem chosen for this study. Geographically, it is located in eastern Canada, North-west of Cornwall, Ontario, and is identified by the following co-ordinates:75°44′ W, 45°08′ S. It is influenced by agricultural land use activities and possibly the Newington Bog and Monkland Drain wetlands. Seasonal and spatial patterns of methyl and total mercury and nutrients concentrations were measured during 2005-2007 in the Raisin River to determine if inputs from farming activities or altered wetlands are contributing to the contamination of this freshwater ecosystem.

1.1 BACKGROUND

In this section, an overview of mercury and methyl mercury in aquatic systems is presented first, followed by an overview of several nutrients in peatlands.

1.1.1 Mercury formation a brief overview

The details of methyl mercury formation in the environment remain controversial. Some researchers have postulated that mercury is methylated by sulphate-reducing bacteria (Compeau and Bartha, 1985; Gilmour and Henry, 1991; Newman and Unger, 2003), while others have reported that iron-reducing bacteria are implicated (Wood et al., 1968; Pak and Bartha, 1998; and Fleming et al., 2006), including abiotic processes. Several factors also affect mercury methylation: (i) increases in sediment depth result in decreased rates of methylation (Rudd, 1995; Matilainen and Verta, 1995); (ii) seasonal variation, typically, summer months are characterized by increases in temperature which promote microbial activity thereby causing increased methylation rates (Babiarz et al., 1998); (iii) epilithic biofilms which harbour a variety of bacteria, some of which can promote methylation (Desrosiers et al., 2006); (iv) macrophytes and periphyton, which are generally associated with sediments, influence the accumulation and production of methyl mercury (Cleckner et al., 1999) and, in the case of a water sediment interface, methylation rates are at least an order of magnitude less compared with periphyton associated methylation (Guimaraes et al., 1998, 2000b; Mauro et al., 2002). In addition as reported by Desrosiers et al., 2006, periphyton in boreal lakes is a significant site of methylation. Simultaneously, methylation and demethylation (chemical re-conversion of methyl mercury to inorganic mercury) can occur in aquatic systems. Demethylation is favored under anoxic conditions and is carried out by sulphate-reducing bacteria, nitrate-reducing bacteria, and methanogenic species (Spangler et al., 1973a, 1973b; Oremland et al., 1995). No net production of MeHg would be expected if demethylation rates are equivalent to methylation rates (Compeau and Bartha, 1984). However, in the presence of oxygen, demethylation rates may be slightly higher than for anoxic conditions (Pak and Bartha, 1998a, 1998b). There is nonetheless general agreement that methyl mercury is formed under reducing conditions associated with low oxygen. Where peatlands are drained for agricultural use, movement of bog water from agricultural sites does occur thereby lowering the water table. There is speculation that sulphides are converted to sulphates and this releases metals which cause increased methylation to occur (Krabbenhoft et al., 1995; Branfireun et al., 1996).

1.2 Mercury sources and transport considerations

Mercury in aquatic systems originates from natural and anthropogenic sources. Natural mercury emissions occur in several ways: degassing of the earth's crusts, evaporation of oceanic constituents and eruption of volcanoes.

Some anthropogenic sources of mercury include mining and smelting operations (specifically due to the burning of amalgams (Malm, 1998; Pfeiffer & Lacerda, 1988)), chlor-alkali plants, coal-fired power and heat generation, and fungicide applications associated with agricultural activities in some areas of the world (Niencheski *et al.*, 2001). Industrial growth has resulted in mercury emission releases into the atmosphere by factors of 3-5 (Rada *et al.*, 1989; Swain *et al.*, 1992). It is estimated that approximately 5500 metric tons of mercury are released annually into the atmosphere, 70% of which is attributed to anthropogenic sources (Trasande *et al.*, 2005).

Undoubtedly atmospheric releases are subject to normal airborne transport mechanisms (dilution, adsorption, precipitation, residence times, etc.) and, as such, mercury has the potential to travel and deposit at large distances from the sources of origin given its airborne residence time of several months (Lindqvist, 1991). Atmospheric deposition rates of mercury in the southern United States is estimated at ~ 18.5 $\mu g\ m^{-2}\ yr^{-1}$ (Benoit *et al.*, 1994; Swain *et al.*,1992), and in Eastern Canada an average of 10 $\mu g\ m^{-2}\ yr^{-1}$ (wet deposition) is reported (Sweet *et al.*, 1999). In Arctic communities where there are virtually no localized mercury point sources, the mercury content in fish is high (Lindberg *et al.*, 2002) and could exceed the recommended human consumption guideline in Canada which is 0.5 μg Hg per gram wet weight (CFIA, 2002); this suggests a global input attributable to manmade activities. Global input is akin to a "grasshopper effect" of organic pollutants, but requires oxidation of elemental mercury (Hg^{+2}) to facilitate absorption in water droplets (O'Driscoll, *et al.*, 2005).

In peatlands, mercury from precipitation is thought to be faithfully preserved year after year with depth since the formation of the wetlands. This idea has been used to identify anomalies in the past, related to major volcanic eruptions and other major mercury releases such as the beginning of gold mining (Givelet *et al.*, 2003).

1.2.1 Methyl Mercury in water bodies

In general mercury transport depends on physical, biogeochemical and seasonal factors (Babiarz *et al.*, 1998). Three sources can contribute to methyl mercury levels in an aquatic system: watershed runoff, direct precipitation and inorganic methylation within the aquatic system (Rudd, 1995). The displacement of surface waters into existing water systems, for example, freshet activities can also be an input source (McGlynn *et al.* 1999). This probably explains why in the Tahquamenon River, methyl mercury concentrations have increased during the spring freshet, which ultimately tend to increase the concentration loading in Lake Superior where 33% of the MeHg originates indirectly from groundwater discharges (Holtschlag and Nicholas, 1998). The relative contribution of these sources to a river system is dependent on the lake type, hydrology of the catchment, and the rates of methyl mercury deposition from the atmosphere (Rudd, 1995).

1.3 Mercury in Peatlands

Some characteristics

Peatlands may be distinguished from other types of land mass based on three general characteristics: (1) water is present at or close to the land surface; (2) there is usually low oxygen content within the soils; and (3) adaptations by biota to survive in the ecosystem (Etherington, 1983; Keddy, 2000; and Mitsch and Gosselink, 2000). Typically situated in headwater regions, they are not fed from water sources other than precipitation. Within a season the water levels within the peatland fluctuate relative to the surface (Seelig and DeKeyser, 2006). The peatland serves several functions which overall appear to affect water quality: it is a site for water storage, it serves as a medium for the exchange or filtration of surface and ground waters, it can undergo chemical transformation and attenuation, and it exhibits biologic diversity and integrity (Seelig and DeKeyser, 2006). Peatlands support acidophilic vegetation (e.g., sphagnum) and have low oxygen concentration and nutrients. Previous studies (St. Louis *et al.* 1994, 1996) have demonstrated that wetlands are major sources of methyl mercury, because they are storage areas for nutrients and mercury (Westling, 1991).

Peatland pH and methylation aspects

Peatlands may be drained for agricultural purposes to provide irrigation sources for nearby crops or for residential development uses; however, such draining releases metals and mercury (Westling, 1991). Peatlands prior to being drained typically have a pH of less than 4.2 (Glaser, 1992), and when draining does occur the pH tends to approach a more neutral state. This finding is supported by Wind-Mulder *et al.*(1996) who showed that peatlands in Quebec and Alberta prior to being drained had a pH lower than 4, but after drainage the pH were found to be in the range of 3.7 to 6.2.

Neutral pH permits growth of bacteria. Most species of sulphate-reducing bacteria are favored at a temperature of 35 °C and a pH of 6.5 (Choi *et al.*, 1994). A large concentration of sulphate in outlet waters from the peatland or inlet waters of a stream does not necessarily mean that there is a corresponding increase in the production of methyl mercury. Instead, there is a threshold concentration in which sulphate is required for optimal methylation. This was demonstrated in a manipulation experiment in which sulphate was added from a level of 100 to 250 mg L^{-1} producing no significant effects on methyl mercury production output from the peatland (Gustin *et al.*, 2006). Under more neutral pH conditions in wetlands, ionic mercury is methylated by sulphate-reducing bacteria (St.Louis *et al.*, 1994; Bishop *et al.*, 1995; Krabbenhoft *et al.*, 1995; Compeau and Bartha, 1985; Gilmour and Henry, 1991; Newman and Unger, 2003). Some studies have suggested that the process of methylation also occurs in sediments (Martin-Doimeadios, 2004; Gilmour *et al.*, 1992;

Choi and Bartha, 1994; Compeau and Bartha, 1985), under conditions that may be aerobic or anaerobic (Amirbahman *et al.*, 2002). In wetland sediments, mercury methylation occurred under conditions similar to that for sulphate reduction (Holmes and Lean, 2006).

In cold temperatures, bacterial activity is slower and mercury retention is longer than is the case for warm temperatures (Miller, 1989). During the spring runoff, mercury concentrations of the bog increased due to increased methylation relative to the winter season, and to melted contaminated snow that enters the system (Miller, 1989). Methyl mercury can be transported from wetlands and soils to river systems as a result of storm water runoff caused by increased precipitation (Grondin *et al.*, 1995; Zillioux *et al.*, 1993); this ultimately leads to decreased mercury levels in nearby water systems because of dilution by storm water. In contrast, periods of low precipitation or drought have been associated with increased mercury loadings in rivers (Grondin *et al.*, 1995; Zillioux *et al.*, 1993).

Manipulation experiments on a peatland revealed that during a summer drying and wetting process, rewetting resulted in an increase of methyl mercury concentrations temporarily, while the largest methyl mercury output was seen during winter drying followed by rewetting during the spring (Gustin *et al.*, 2006). Generally when there is fluctuation of the overall water levels within the peatland, an increase of methyl mercury production tends to occur (Kelly *et al.*, 1997). Overall, it is highly plausible that the surrounding wetlands contribute to most of the methyl mercury present in the nearby lakes and river systems (St. Louis *et al.*, 1994; Barbiarz *et al.*, 1998).

For wetlands in North America, an increase in total mercury is correlated with an increase in methyl mercury. It has been documented that a boreal forested wetland may release up to a 39-fold increase in methyl mercury into nearby bodies of water after a flooding event (Kelly *et al.*, 1997). Peatland areas that were sampled in Ontario and Quebec, specifically, Coopers Marsh, Baie St. Francoise, the Otter Lake region and Stillwoods (North Gower, Ontario), demonstrated levels of methyl mercury in the range of 0.078 to 0.702 ng L^{-1} (average ~ 0.298 ng L^{-1}), while total mercury values ranged from 1.0 to 2.6 ng L^{-1} (average ~1.55 ng L^{-1}), and the percentage of methyl mercury as total mercury varied between 4.6 and 63.6% (average ~26 %) (Holmes and Lean, 2006). Sometimes percentages of total mercury as methyl mercury are relatively low in water bodies. For example, in the Florida Everglades, values were in the range of 0.2-2% (Gilmour *et al.*, 1998).

Some wetlands have demonstrated a seasonal occurrence for increases in methyl mercury production. This effect is apparent for the Roseau River, Minnesota (which consists of 8% wetland area cover) where it was observed that methyl mercury concentrations tended to decrease from July until October from 1.55 ng L^{-1} until 0.16 ng L^{-1} (Balogh *et al.*, 2006). Similarly, at the Rum River in Minnesota (consisting of 9.2% wetland cover), the percentage of total mercury as methyl mercury decreased over the summer 2002 but then sharply increased to ~39% by September 2002 (Balogh *et al.*, 2006). For wetland areas in Wisconsin, Babiarz *et al.*, 1998 observed differences during the spring freshet and the fall season for methyl mercury concentrations, that ranged from 0.88 to 1.88 ng L^{-1}.

In addition to seasonal variations there are also spatial variations in mercury yields. In Wisconsin it was observed that methyl mercury yields ranged from 360 to 5850 ng m^{-2} $month^{-1}$ with wetlands contributing the higher yields (Babiarz *et al.*, 1998). At Allequash Creek, Wisconsin, the methyl mercury yields were much less, ranging from 18 to 45 ng m^{-2} $month^{-1}$ for the wetland region (Krabbenhoft *et al.*, 1995). In a peatland region of Minnesota, the S2 watershed in Marcell Experimental Forest had a mercury yield of 233 ± 25 ng m^{-2}

month^{-1} (Grigal *et al.*, 2000), a value that is much less than those of the wetlands of Wisconsin. This overview demonstrates that mercury concentrations and yields are highly variable and difficult to approximate since several environmental factors control export and production. Such information is valuable in minimizing the alterations of wetlands to minimize mercury export.

1.4 The influence of nutrients on trophic state and redox conditions of aquatic systems

This section contains information on several nutrients which may be found in water systems and peatlands. It is widely held that phosphorus is the limiting nutrient in many aquatic systems, but recently the role of available nitrogen (nitrate and ammonia) has been shown to control the biomass of plant species as well as the environmental conditions related to oxygen levels and redox conditions.

1.4.1 Nutrient in water systems

Dissolved Organic Carbon (DOC) and Mercury aspects

Dissolved organic carbon is the name given to a complex organic matrix of molecular mass from about 1 to 200 kD (kiloDalton). It is the fraction of organic material that passes membrane filters but much of it is of colloidal size. DOC originates from plant and animal decomposition usually under low oxygen conditions and includes the fractions commonly referred to as humic and fulvic acid. DOC is the principal attenuator of ultraviolet radiation (Lean, 1998) and can limit the penetration of visible light, but suspended particulate material also plays a role.

DOC concentration is highly correlated with methyl mercury concentration in water (Aiken, 2002; Watras *et al.*, 1995). DOC can act as a substrate for methylating bacteria and the formation of micronutrients (Gill and Bruland, 1990) thereby leading to DOCMeHg complexes, but such binding would be dependent on their chemical compositions (Babiarz *et al.*, 1998). DOC can exhibit an inhibitory effect, primarily by organic ligands binding with mercury thus lowering methylation (Ullrich, 2001). DOC can also affect the pH level of the host water system (Silveira, 2005). When DOC was plotted against methyl mercury for 7 Wisconsin Lakes, the regression correlation was significant ($p =< 0.0001$) with an r^2 value of 0.61 (Babiarz *et al.*, 1998). Similarly, regression statistical significance was also established when DOC and total mercury was plotted, yielding $p=<0.0001$ and $r^2 = 0.72$ (Babiarz *et al.*, 1998).

Temporal patterns for DOC and mercury concentrations were observed at Allequash Creek, Wisconsin, where DOC increased during the fall causing total mercury concentration increases by a factor of 2 to 3 (Krabbenhoft *et al.*, 1995). It is clear that the links between DOC and mercury are significant but there remains much to be discovered.

Nitrates and Ammonia

The nitrogen cycle within both terrestrial and aquatic ecosystems has been altered by human activities (Kinzing & Socolow, 1994; Vitousek *et al.* 1997), primarily by agricultural processes and nutrients released from sewage treatment plants and water storage facilities (Wilkinson and Greene, 1982).

Nitrate (NO_3^-) is a product of nitrification, a two-stage process in which ammonia (NH_3) is converted into nitrite, which then is converted to nitrate by nitrifying bacteria.

Common sources of nitrate include animal wastes, fertilizer and vehicle exhausts (nitrous oxides). Ammonia may enter the riverine ecosystem by the decay of nitrogenous waste, manure application to crops, fertilizer application, and sewage effluent (Misselbrook *et al.*, 2000). Oceans receive <30% of anthropogenic nitrogen inputs from runoff from surface waters, streams and rivers (Howarth et al., 1996; Boyer et al., 2002); the remainder (of anthropogenic nitrogen) is retained in watersheds, volatilized or denitrified to nitrous oxide or nitrogen gas (Mayer *et al.*, 2002). It is difficult to determine quantitatively the type of anthropogenic source that is stored specifically in the watershed (Van Breeman *et al.*, 2002), but it is suggested that certain inputs are retained differently throughout the system (Howarth *et al.*, 1996) depending on factors such as the redox conditions, weather, soil, and the type of farming.

For drinking water the nitrate concentration limit is 10 mg L^{-1} (WHO, 2003). In water systems of temperate regions of North America nitrate levels tend to be highest during the late fall, winter and spring, which may in part be attributed to low uptake of nitrate by plants during those seasons. Increases in nitrate concentration in such water systems would also be caused by runoff (Goolsby *et al.*, 1991). High nitrate concentrations can be harmful and may lead to methaemoglobinemia in humans. Essentially in this process, nitrates are converted to nitrites which react with haemoglobin in the blood to form methaemoglobin, which, ultimately decreases oxygen transfer from the blood to tissues (WHO, 2001). The effect in babies is often referred to as 'blue baby syndrome', and adults who have a suppressed immune system can also incur similar adverse health affects (WHO, 2001).

High levels of ammonia and nitrate can contribute to increased biomass levels of phytoplankton and periphyton (Dodds *et al.*, 1998). It also can increase or decrease insect species as reported by Beketov (Beketov, 2004) who observed a decline in the Mayfly species with increased nitrogen concentration. Ammonia concentration greater than 1 mg L^{-1} are toxic to fish communities (Miltner and Rankin, 1998) and nitrification of ammonia can be a major oxygen depletion mechanism in both winter and summer.

Total Phosphorus

Total phosphorus is a measure of both dissolved and particulate phosphorus within a sample. Biological productivity in lakes is thought to be nutrient limited by phosphorus (Smith, 1984), but in rivers the combined effect of phosphorus and nitrogen seems to be important (Dodds and Welch, 2000). Total phosphorus concentrations at the subsurface water level can be influenced by external and internal sources to the system. External sources of phosphorus include precipitation, rock weathering, ground water, point source discharge, sewage, livestock feed, fertilizer runoff, and detergents. Overall, the total phosphorus loading from external sources is dependent on the use of water by the population, agricultural uses as well as fertilizer applications (Howarth *et al.*, 1996; Caraco and Cole, 1999). It was found that phosphorus constituents of livestock runoff caused aquatic organisms downstream to die and also resulted in the formation of algae blooms in rivers (Taylor, 2000). Internal sources (sediment release) may also contribute to the total phosphorus concentration. In addition, macrophytes which take up phosphorus from sediments can release phosphorus back into water. At each step of the food chain, animals consume organic material and release inorganic phosphorus (Wetzel, 2001), and it can be assumed that the phosphorus is the dominant nutrient controlling the trophic states of streams and rivers (Dodds and Welch, 2000).

It has been demonstrated that the application of fertilizers or animal manure prior to runoff has contributed to the highest concentrations of dissolved phosphorus in agricultural settings (Romkens *et al.*, 1973; Daniel et al., 1995). This can be explained by phosphorus inputs increasing into the river after rainfall, due to the stored phosphorus contained in the soils being leached and then manifest in the runoff (Staver and Brinsfield, 2001). In this respect, it is important to acknowledge that runoff quality from various spots across the watershed do vary and this variability would translate in some areas contributing higher concentrations of dissolved phosphorus being inputted into the water column compared to other areas (Gburek and Sharpley, 1998).

The Ontario provincial guideline for phosphorus in rivers is 30 $\mu g\ P\ L^{-1}$. The average phosphorus concentration of the Raisin River Watershed is 134 $\mu g\ L^{-1}$ (RRCA, 2006), which exceeded the provincial guideline (RRCA, 2006). Holmes (2005) reported values for temperate wetlands in south eastern Ontario and western Quebec from 15 to 800 $\mu g\ L^{-1}$. In the range of 15-120 $\mu g\ L^{-1}$, he found a relationship with methyl mercury concentration in the water after correcting for sulphide and pH levels. Increased nutrient inputs contributed to higher levels of methyl mercury in the system. This also resulted in a decline of macrophyte diversity; however, the overall primary production of the system increased, resulting in depletion of oxygen from the sediments creating favorable reducing conditions. It was demonstrated that anoxic waters have a high concentration of dissolved reactive phosphorus (Balogh *et al.*, 2006) and sulfide. Up to the level at which sulfide increases to the point where mercury is immobilized, these conditions support an environment for microbes that are responsible for sulphate reduction. Similar studies of coastal wetlands in South Carolina revealed that bacteria communities within the soil were limited by phosphorus

(Sundareshwar *et al.*, 2003), and that methyl mercury and total mercury correlate positively with periphyton, nitrogen and phosphorus (Simon *et al.*, 1999).

1.5 Rationale

The above discussion of mercury and nutrients provides a background on how these contaminants influence river systems and peatlands. The Raisin River is influenced by a variety of agricultural landuse activities. The peatlands included in this study area consisted of drainage ditches which allow movement of bog water from agricultural sites of interest and which were often deeper than 3 m and extended for kilometers, comprising other wetlands.

This thesis is a component of the Watershed and Environmental Resource Assessment Project (WERAP), which had an overall goal to identify factors that influence water quality of the river and to suggest possible water management strategies. Unlike other studies this work was conducted in an agricultural drainage basin.

The objectives of this study are:

1. To determine seasonal and spatial patterns of methyl and total mercury concentrations at selected sites throughout the Raisin River watershed, since there is not much information available of such loadings in that area. Sites were chosen in collaboration with the St. Lawrence River Institute of Environmental Sciences, based on physical characteristics and sampling accessibility. Consideration that the River is fed from 3 Branches which are influenced by agricultural activities and is subject to all four seasons (spring, summer, fall and winter) on an annual basis, seasonal and spatial relations are

likely to be revealed. The application of Kruskal-Wallis statistical analysis would help in the identification of such correlations.

2. To determine if there is a correlation between methyl mercury and nutrient concentrations. Positive correlations would help establish MeHg nutrients relationships. This may provide insights into potential management practices that could be adopted to limit runoff quality that increases methylation and MeHg inputs into the River. Use of Spearman statistical analysis would help identify such correlations.

3. To test the hypothesis that methyl mercury and total mercury in the Raisin River are elevated due to (i) export from peatlands altered by human activity, and (ii) landuse. Conceptually, since drainage of peatlands causes neutral pH which promotes bacteria for methylation, MeHg inputs should increase at headwater sites of the River. The yield calculations were used to verify mercury and nutrient inputs into the River.

The conclusions arising from this study provide insights that may be useful in future water management strategies, especially in agricultural drainage basins where there is little data for nutrient and mercury contamination.

2. MATERIAL AND METHODS

2.1 Area under study

The Raisin River system is located in Eastern Ontario and comprises a total of 809 km of streams, and the total area of the sub-watershed for the Raisin River is 57 982 ha

(RRCA, 2006). The Raisin River watershed possesses mainly two types of soils. The first is clay loam which generally has poor drainage while the other is referred to as loam and characteristically allows good drainage (RRCA, 2006). The eastern portion of the watershed does possess areas that have marine clay along with glaciomarine sands (Cane and Clark, 1999).

The Raisin River consists of 3 branches: the Main, South, and North (Figure 1, page 25). However, for this study these branches were further sub-divided to yield 5 Divisions: Main, South, North, Composite, and North + Main. A total of 17 sites were chosen for study along these Divisions. The North Division was comprised of 3 sites (RR22, RR20, and RR16); the Main consisted of 5 sites (RR21, RR19, RR18, RR17, and RR15); the South Division contained 5 sites (RR1, RR2, RR3, RR4 and RR5); the Composite site was RR6; and the North + Main Division consisted of RR13, RR12, and RR7 (Figure 2, page 26). The Composite Division is considered the sum of the North + Main and South Branches. In the vicinity of the Raisin River are two peatland areas: the Newington Bog (Figure 3A, page 27) and Monkland Drain (Figure 3B, page 28). These peatlands were trenched 10 to 12 feet deep and 20 feet across, along with smaller trenches which allowed the movement of water originating from the peatland to be directed to fields for agricultural purposes. The fluctuation in water levels in the Newington Bog about 20 years ago led to the idea of developing the site for peat harvesting, but this activity has not yet been realized.

In this study water samples were collected from two sources. First, the 17 sites which are considered the primary sites of investigation are identified along the 3 major branches of the Raisin River as described above. Sampling was undertaken on a seasonal basis from June 2005 to August 2006 with the exception of late winter sampling. Elevated levels of some nutrients and methyl mercury were measured in the headwater regions. Consequently, from June 2006 to May 2007 monitoring was extended to the Newington Bog and Monkland Drain which drained into the headwaters of the Raisin River. Samples were collected at various locations in the trenches of the peatland outflow.

2.2 Sampling technique and preservation

Water samples for nutrient and methyl mercury analysis were collected in 10% HCl acid-washed 1L nalgene-HDPE bottles that were previously washed with 10% HCL followed by rinsing 5 times with distilled water. Methyl and total mercury samples were collected in duplicate, while single bottles were used for nutrients analyses. From the nutrient bottle, nutrient analyses were run in duplicate. Field sampling was conducted by members of the St. Lawrence River Institute of Environmental Sciences. At time of collection, specific conductivity readings were performed using the YSI 85 Dissolved oxygen, temperature and conductivity meter. The subsequent sampling of the peatland sites was conducted by the researcher with assistance from the thesis supervisor. From the 1L nutrient water samples collected, 250 mL was removed for total phosphorus analysis. This sample was stored in a HDPE bottle at 4°C and was acid preserved with 1 mL of concentrated sulfuric acid. The remaining water sample was filtered with a Whatman GF/F 45-mm round-fiberglass filter. Filtration occurred within 24 hours after the samples were collected. The filtrate was then separated into several 50mL falcon tubes for ammonia, nitrate, sulphate and DOC/DIC analysis. Filtrates analyzed for ammonia, sulphate, and nitrate concentration were stored in a freezer until thawed 24 hours prior to analysis. Filtrates for DOC/DIC and ammonia analysis were stored at 4°C and analyzed within 150 days following collection.

A 50 mL subsample was removed from the 1 L methyl mercury sample, in clean room facilities, for total mercury analysis and stored in pre-rinsed (de-ionized water) falcon tubes that had been checked to be sure that they were mercury free and preserved with 400 $\mu g\ L^{-1}$ of bromine chloride (Holmes, 2005). Methyl mercury samples were then preserved with 5 mL of concentrated hydrochloric acid (EM Science, ACS grade 99%). The methyl and total mercury samples were stored in a cold room at 4°C until analysis.

2.3 Nutrient analyses

The Lachat nutrient analyzer 8000 QuikChem version was used for nitrate, ammonia, sulphate, and total phosphorus nutrient analysis. The Lachat QuickChem Method 10-107-04-1-C (Lachat Instruments, 2000) was used to conduct nitrate analysis. The Lachat QuikChem Method 10-107-06-1-J (Lachat Instruments, 2001) was followed when conducting ammonia analysis. According to Lachat QuikChem Method 10-116-10-1-C (Lachat Instruments, 2003), sulphate analysis was performed. Using the Lachat QuikChem Method 10-115-01-1-F (Lachat Instruments, 2000) by flow injection, total phosphorus was conducted. For each nutrient analysis sample, two readings were taken (pseudo-duplicate), except for total phosphorus analysis in which three subsamples were analyzed. Readings so obtained were averaged.

DOC and DIC analysis was conducted, using the O-I-Analytical 1010 Total Organic Carbon Analyzer instrument. Triplicate readings were averaged and concentrations were obtained by comparison to calibrated standards.

2.4 Mercury analyses

For methyl mercury analysis, the methodology described in Cai *et al.*, 1996, using capillary gas-chromatography-atomic fluorescence spectrometry following solid phase extraction. It involves the use of 2:1 acidic KBr/CuSO4 solution, followed by extraction with 300 μL of dichloromethane to obtain the organic layer of the solution. These sample extracts were analyzed using standard capillary gas chromatography paired with atomic fluorescence spectrometry ((GC-AFS), Analytical Mercury System Model PSA 10.723) (Cai *et al.*, 1996). During the process of methyl mercury determination blanks were run to ensure that methyl mercury contamination was not present, as reported by Holmes and Lean, 2006. Area peaks were integrated and concentrations were calculated.

Total Mercury analysis was carried out using EPA method 1647 with the cold vapor atomic fluorescence spectroscopy (CVAFS). Tekran 2600 and Tekran 2610 liquid handling modules and Tekran 2620 autosampler were the instrumentation used in conjunction with the spectroscope mentioned previously, as adapted from the study by Homes and Lean, 2006. The respective procedure involves 100 μL of 30% hydroxylamine solution to be added to each sample prior to analysis. Concentrations were calculated based on a standard calibration curve possessing an R^2 value of 0.9 or higher.

2.5 Statistical analyses

Statistical analyses were applied to the contaminant concentration data. These were in the form of nonparametric testing and conducted using SYSTAT computer based statistical analyzer version 12.0. Specifically, to determine if any significant relationships existed between the contaminant of interest and sites as well as seasons, one-way Kruskal-Wallis analyses were applied. Since the concentration data followed an unbalanced form it was not possible to conduct Friedman's analyses of variance (parametric equivalent would be the 2-way ANOVA) to determine if a relationship existed between the interaction of sites and seasons. For each Division, the sampling seasons were based on the calendar year and 6 groups were identified: Spring 2005, Summer 2005, Fall 2005, Late Winter 2006, Spring 2006, and Summer 2006. For the Newington Bog and Monkland Drain regions seasons were divided into summer, fall, winter and spring. These groupings were used to determine temporal significance using the Kruskal-Wallis statistical analysis. Also, Kruskal-Wallis analyses were carried out to determine statistical significance between sites for 4 Divisions (except the Composite Division which has only one sampling point) and for the Peatlands (Monkland Drain and Newington Bog consisted of 2 and up to 5 sampling sites, respectively).

Spearman statistical analysis was used to determine the relationships between mercury and several nutrients (ammonia, nitrate, total phosphorus, sulphate, DOC and DIC), including specific conductivity, dissolved oxygen, and temperature for the Peatland sites. Hence, results are presented for each of the peatland sites and the 5 Divisions of the Raisin River. SYSTAT 12.0 was utilized to obtain the Spearman correlation coefficient; additionally a Spearman Rank Order Correlation Coefficient calculator (Lowry, 1998-2007) was applied to compute the p-value ($p<0.05$ is considered significant) in order to establish significant results.

2.6 Yield calculations

Yield calculations for nutrients, total Hg and MeHg were made using the following generalized equation as adapted by Babiarz *et al.*, 1998:

Yield (mg m^{-2} month $^{-1}$) = concentration (mg L^{-1}) x volumetric flow (L $month^{-1}$) ÷ area (m^2)

Several approximations and assumptions were made in order to perform the calculations. For concentration parameters, it is to be considered that even though sampling occurred from June 2005 to August 2006, some sites were sampled more frequently than others, and sampling did not occur in all months. Therefore, some simplifications were adopted. For example, in a case where one measurement was obtained in a month that value was considered the monthly average, and where several measurements were made the monthly averages were used.

Directly measurable volumetric flow data for the Raisin river was available at one site only (Figure 4, page 30). Precipitation in the river systems is influenced by both rain and snow contributions. Rain precipitation readings, measured in millimeters, were collected daily at the Climatological Station located at the Water Filtration Plant by the City of Cornwall. The sum of the monthly precipitation, showing separately rain and snow amounts, is shown in Figure 5 (page 32). Previous studies of Allen and Benke, 2005 showed that for 9 rivers within the St. Lawrence region 60% of precipitation is lost through evapotranspiration while 40% of precipitation is due to run-off, meaning that such runoffs potentially may enter a body of water at the sub-surface level. Similarly, the average value for several lakes sampled in North America is about 63% of precipitation, principally lost to the atmosphere via evapotranspiration mechanisms; also, there is about 84 cm annual precipitation and 31 cm (~37%) for runoff (Allen and Benke, 2005). Other investigators in North America have reported similar data, 67cm precipitation with 29 cm (~ 43%) runoff (Hornberger *et al.* 1998), and 76 cm precipitation and 34 cm (~46%) runoff (Shiklomanov 1993).

The sample collection period includes the winter season for which snow is the predominant form of precipitation. Thus snowfall needs to be taken into account. Snow precipitation is generally recorded in centimeters of snow (Ridal, 2007). For a typical snowfall, Dube (2003) demonstrated that the ratio of snow to water was 10:1, and this ratio was applied in the conversion of snow precipitation to water equivalence. Hence, for the yield calculations reported in this study, 40% of the total monthly precipitation, which comprises the sum of the rain and snow contributions, was used as the volumetric flow rate in the equation, based on the assumption that there are no gains or losses from groundwater or surrounding basins; this approach is consistent with that suggested by Allen and Benke (2005).

Estimates of the specific watershed areas upstream were obtained with the aid of a digital elevation map (Geobase, 2007). This Geobase is a Canadian geographic information data base used for land management applications for terrain modeling, and can provide areas of land masses by entering longitude and latitude (Geobase, 2007). In principle, Geobase is used in conjunction with Arc GIS (courtesy of Dr. Sean Carey) to calculate drainage basin at the sites of interest. The area, expressed in km^2 of the drainage basin, was determined and summarized in Table 1 (page 23).

Yields were assessed to determine relationships associated with land features at each site (Table 2, page 24). Land features were interpreted from LANDSAT Thematic Mapper satellite remote sensing data from 1991 to 1998 (Appendix A, page 225).

Table 1. Area of drainage basin as calculated utilizing GIS and digital elevation data. Area given for site incorporates the area upstream as well.

Division	Site (Upstream to Downstream)	Area of Drainage Basin (km^2)
North	RR22	25.13
	RR20	73.78
	RR16	122.94
Main	RR21	19.97
	RR19	15.50
	RR18	42.25
	RR17	59.50
	RR15	102.73
North + Main	RR13	236.50
	RR12	263.99
	RR7	311.54
Composite	RR6	441.32
South	RR1	9.63
	RR2	23.20
	RR3	42.28
	RR4	67.71
	RR5	101.08

Table 2. Summary of land features at each site.

Division	Site (Upstream to Downstream)	Summary of Land Features at each Site
North	RR22	All mixed forest (coniferous and deciduous in sparse and dense patches)
	RR20	~2% cropland, remaining percentage is mixed forest with coniferous and deciduous (some areas are more dense than others)
	RR16	~5% sparse deciduous forest, ~7% is abandoned fields/pastures, remaining percentage is cropland
Main	RR21	~<10% abandoned fields/pasture, remaining percentage is mixed forest (coniferous and deciduous in sparse and dense patches)
	RR19	~<10% cropland, ~15% settled/developed land, remaining percentage is abandoned fields/pastures
	RR18	~15% cropland, 30% abandoned fields/pastures, remaining percentage is mixed forest (coniferous and deciduous)
	RR17	~7% cropland, ~12% mixed forest, remaining percentage is abandoned fields/pastures
	RR15	~<5% sparse deciduous forest, 25% abandoned fields/pastures, remaining percentage is cropland
North + Main	RR13	~10% abandoned fields/pastures, remaining percentage is cropland
	RR12	~<5% sparse deciduous forest, ~20% abandoned fields/pastures, remaining percentage cropland
	RR7	~25% abandoned fields/pasture, ~35% settled/developed land, remaining percentage is cropland
Composite	RR6	~25% abandoned fields/pastures, remaining percentage is croplands
South	RR1	~7% cropland, ~10% abandoned fields/pastures, ~10% settled/developed land, remaining percentage is mixed forest (coniferous and deciduous in sparse and dense patches)
	RR2	~10% cropland, remaining percentage is mixed forest (coniferous and deciduous in sparse and dense patches)
	RR3	~<10% settled/developed land, ~30% cropland, remaining percentage is mixed forest/sparse deciduous
	RR4	~25% abandoned fields/pastures, remaining percentage is cropland
	RR5	~25% sparse deciduous forest, ~35% cropland, remaining percentage abandoned fields/pastures

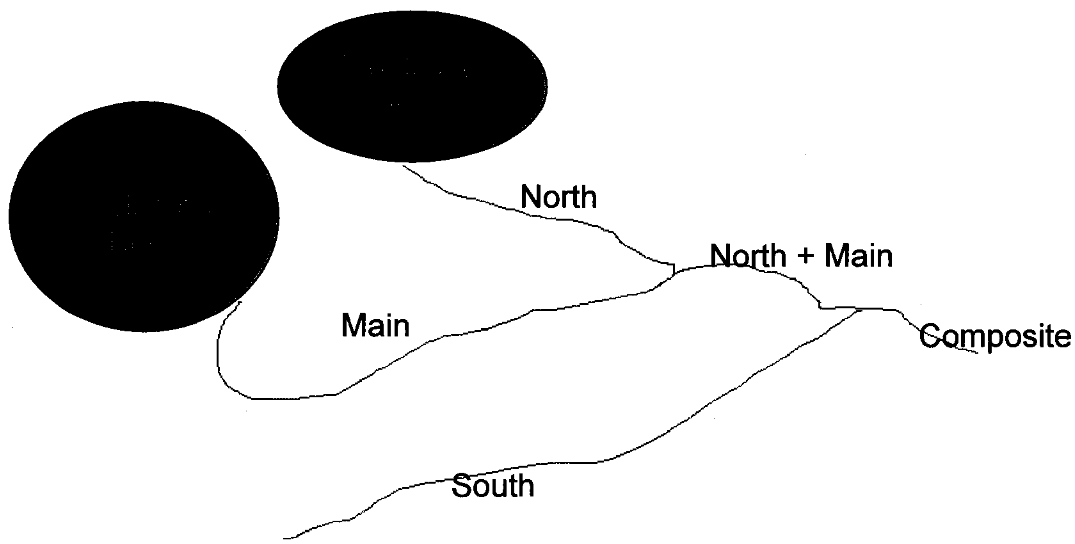


Figure 1. Visual representation of sampling locations including the 5 Divisions and the Peatlands (Newington Bog and Monkland Drain). (Diagram is not to scale.)

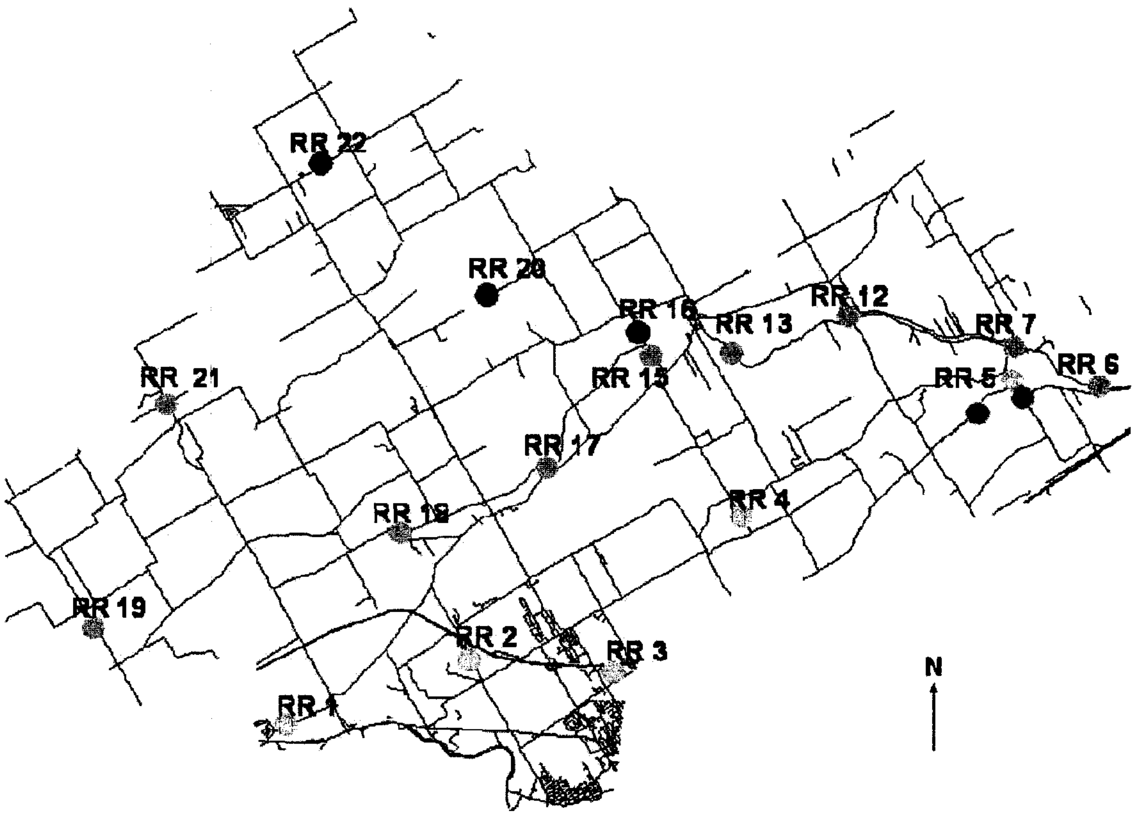


Figure 2. GIS map displaying all 17 sites sampled from the Raisin River, Eastern Ontario.

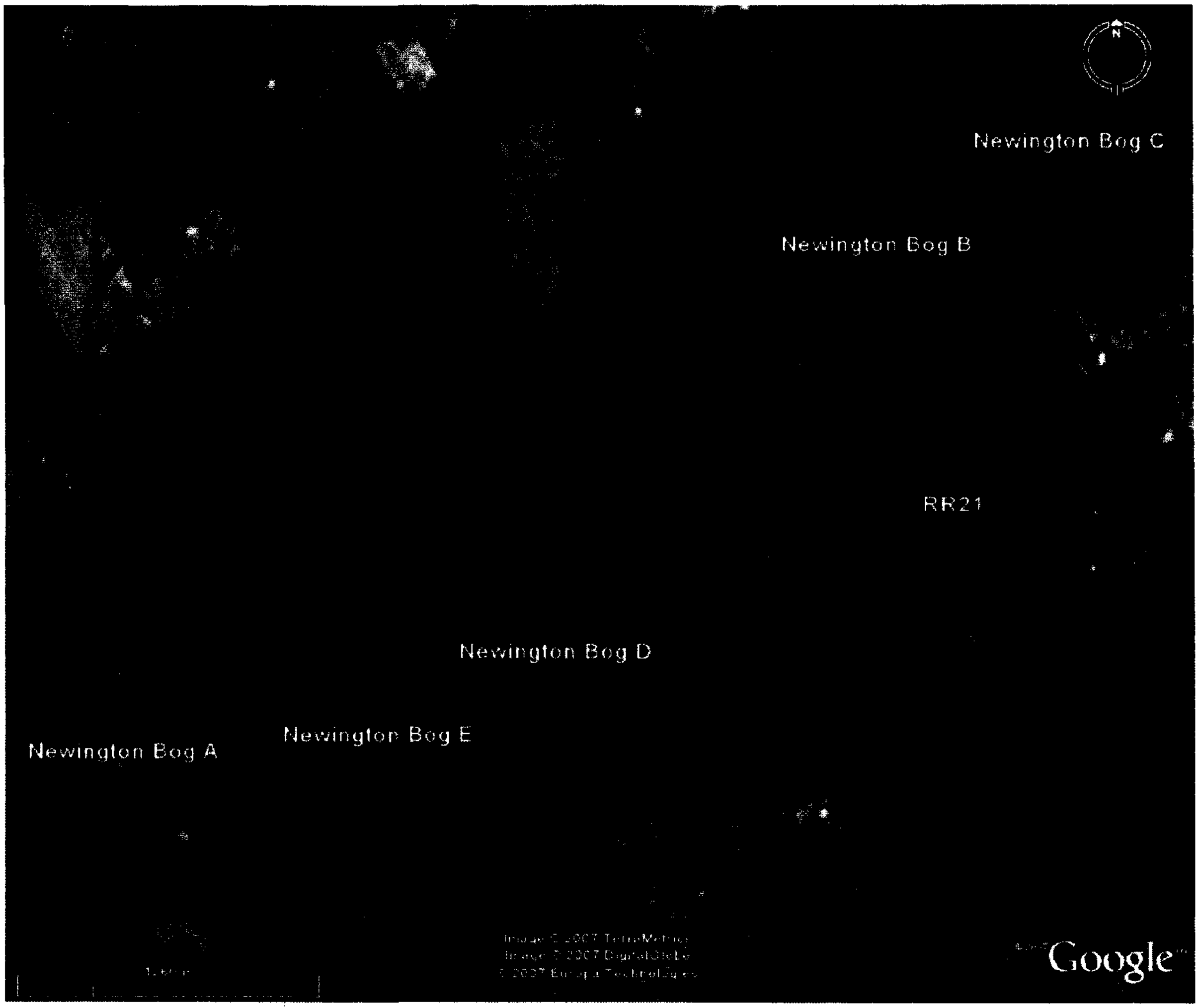


Figure 3A. Satellite generated map of the Peatland sampling sites. The 5 Newington Bog Sites with relation to RR21 are shown (Google Earth, 2007).

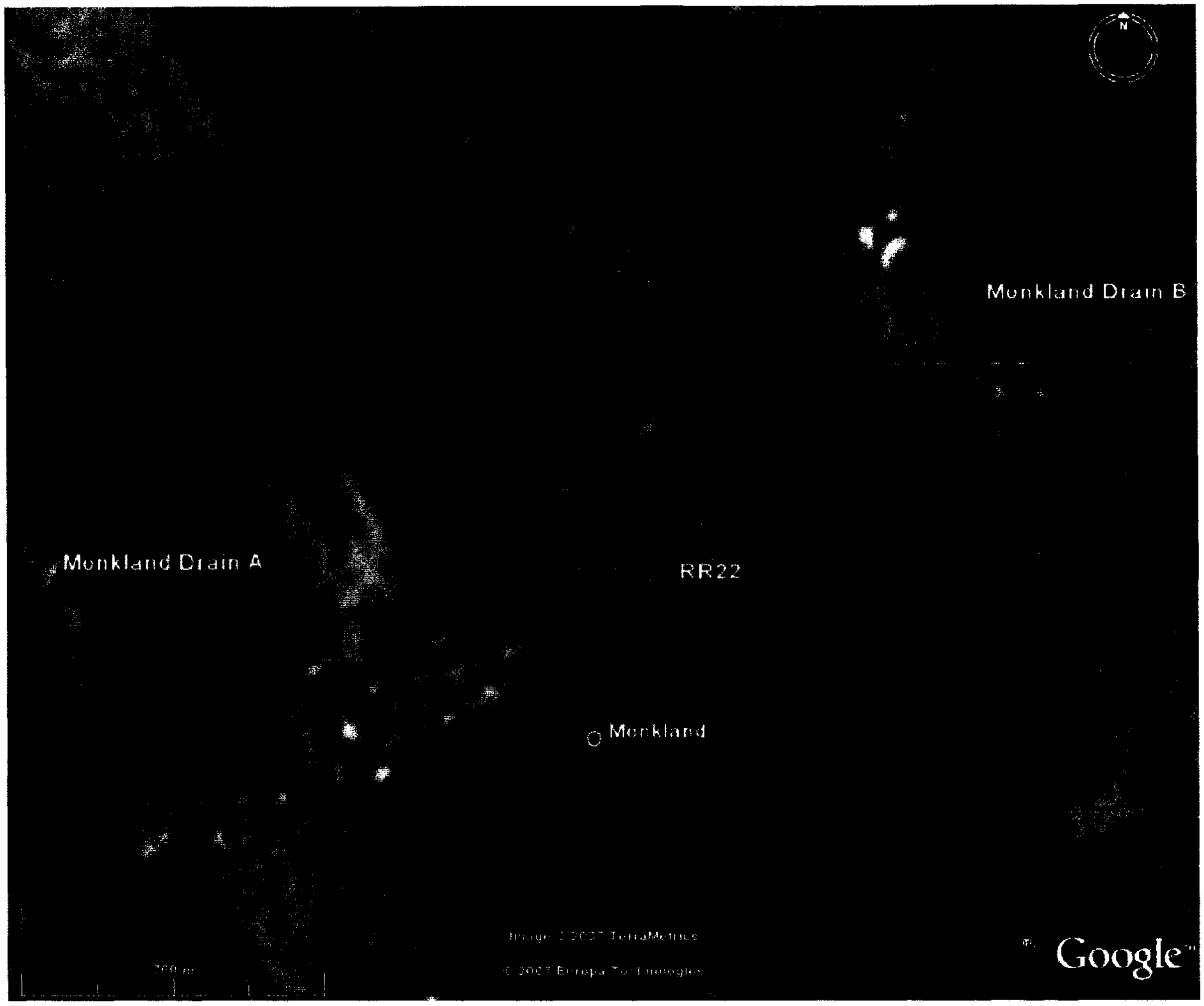


Figure 3B. Satellite generated map of the Peatland sampling sites. Monkland Drain A and B are indicated with relation to RR22 and Monkland (Google Earth, 2007).

Figure 4. Hydrograph demonstrating flow at the Williamstown Water Survey of Canada Station (located nearby to RR12) from January 2005 to 2007.

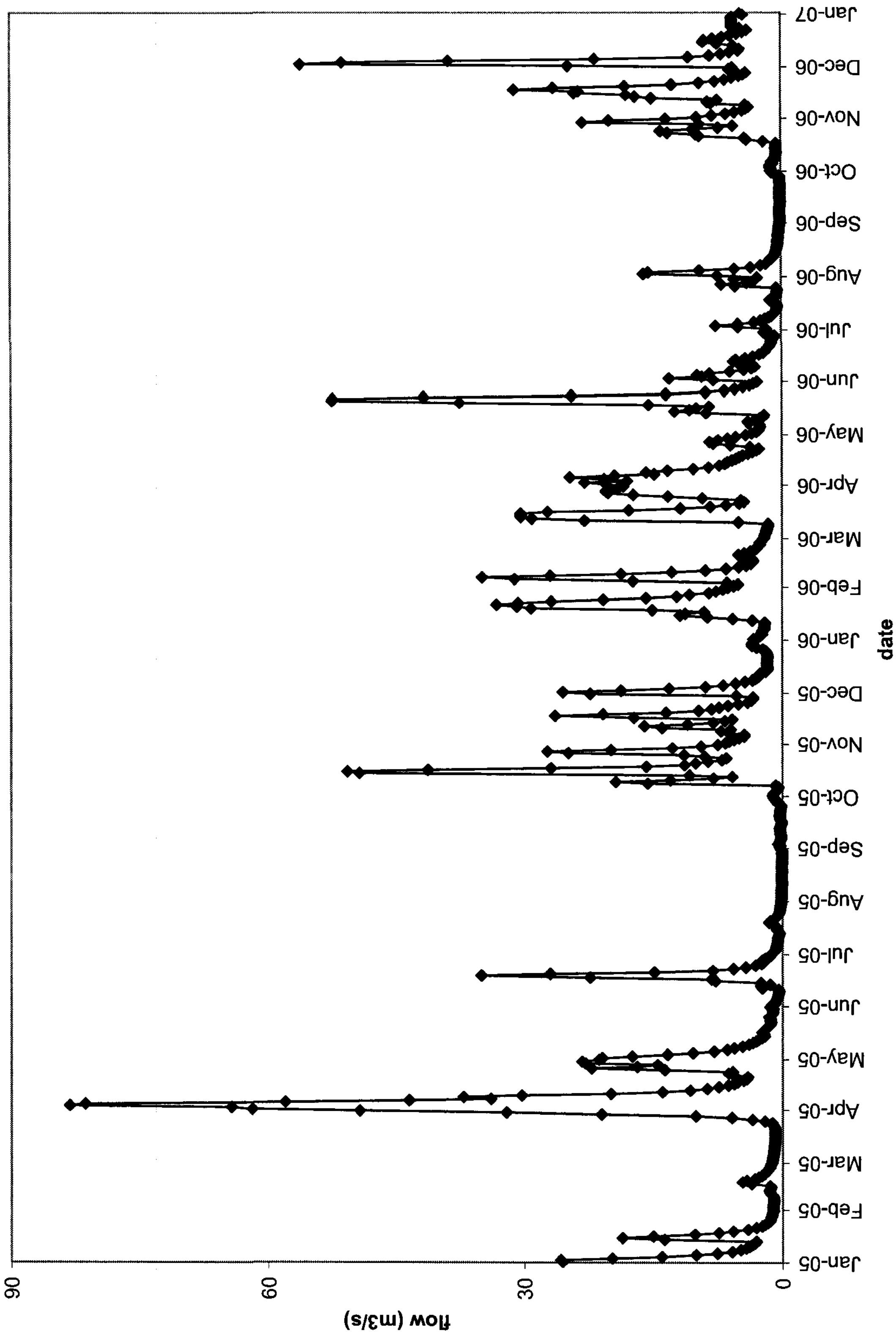
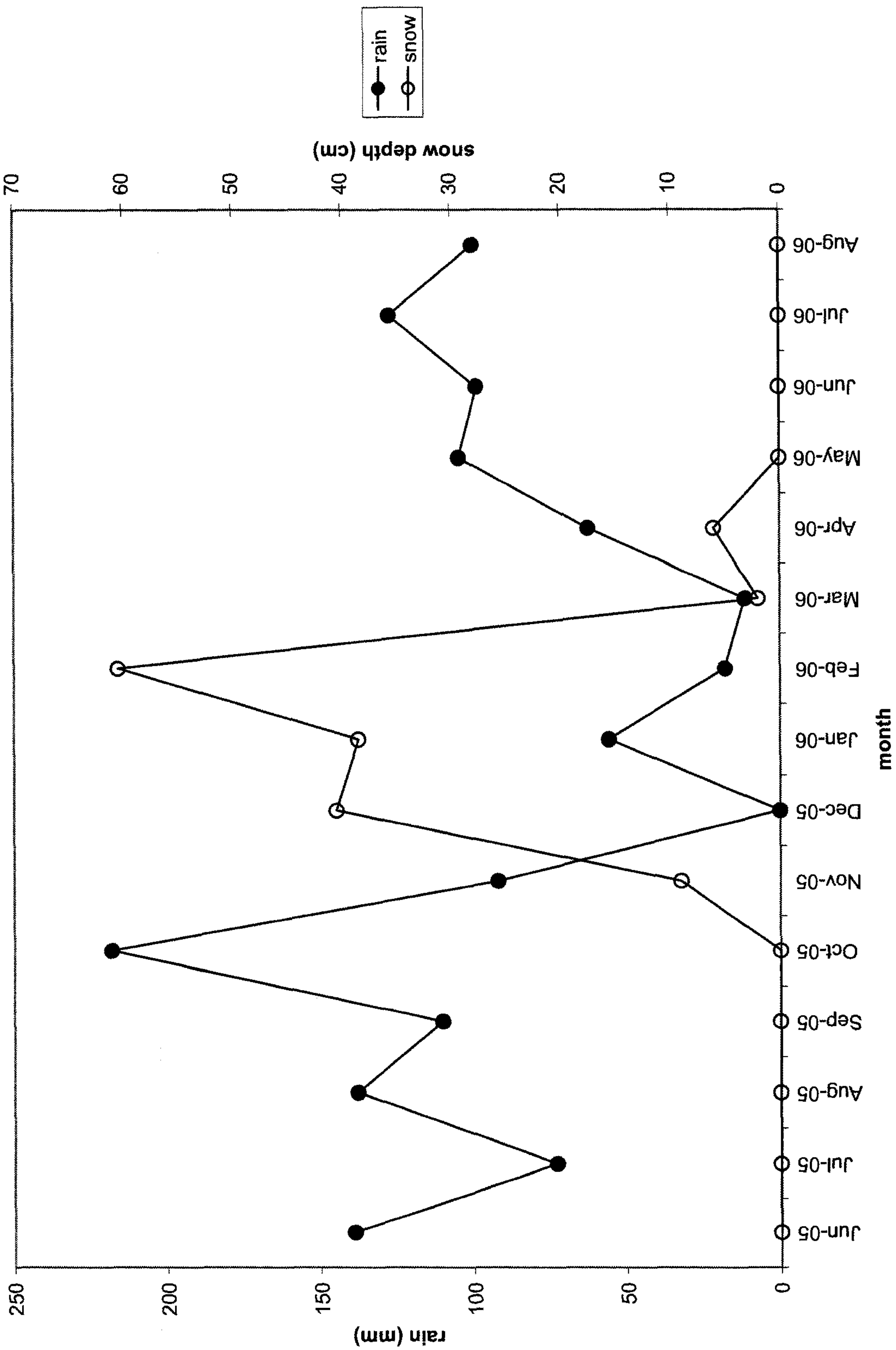

flow (m3/s)
0
30
60
90
date
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06
Jul-06
Aug-06
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07

Figure 5. The sum of the monthly precipitation, separately showing rain and snow amounts.


rain
snow
snow depth (cm)
0
10
20
30
40
50
60
70
rain (mm)
0
50
100
150
200
250
month
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06
Jul-06
Aug-06

3. RESULTS

3.1 Mercury and nutrients in the 5 Divisions of the Raisin River

The results arising from this study are presented in the following order: graphical representations of mercury and nutrient results for all divisions; Kruskal-Wallis and Spearman statistical test results from which spatial and temporal, and mercury and nutrient relationships can be deduced; and yield calculations to help identify source areas for pollutants.

3.1.1 North Division

Figure 6A (page 57) shows the highest methyl mercury (MeHg) concentration (1.02 ng L^{-1}) for the North branch occurred at RR22 during July 2005, with a slightly lower concentration (0.72 ng L^{-1}) observed in August 2006. Collectively for all sampling seasons and sites, the lowest MeHg concentrations were (from 0.05 to 0.61 ng L^{-1}) observed at the downstream site, RR16. In June 2005, October 2005, and March 2006, the midstream site, RR20, showed higher MeHg concentrations than for RR22. But for all other sampling times, RR22 yielded the highest MeHg concentrations. From May to June 2006, MeHg concentrations generally increased at RR16 and RR22. In comparison for the fall season, MeHg concentrations generally decreased at RR16 and RR22 and remained so throughout the winter.

In general for all sampling days, RR22 yielded the highest total mercury (THg) concentrations, with the exception of RR16 which peaked at ~3.0 ng L^{-1} (Figure 6B, page 59). In August 2005, RR20 presented a THg concentration of ~2.4 ng L^{-1} which remained relatively unchanged until March 2006 (~2.75 ng L^{-1}). Overall, THg concentrations increased in June and July 2005 (from ~ 2.42 to 3.47 ng L^{-1}). Except for a decrease in late July 2005 (from ~1.08 to 1.73 ng L^{-1}), THg concentrations were observed to increase for the remainder of the summer and for the fall season. A similar trend was observed in the period from March to June 2006 at which time the THg concentrations increased and were in the range of ~1.58 to 4.24 ng L^{-1}.

Overall for the North Branch, the highest percentage of total mercury as methyl mercury occurred in the summer and was in the range of 13.8% – 59 % as shown in Figure 6C (page 61). The maximum percentage (59%) occurred in late June 2005 at RR22 and RR16 by comparison peaked at ~32%. While the percentage of total mercury as methyl mercury decreased from July 2005 to May 2006, there is an apparent increase beyond May. The percentage of total mercury as methyl mercury shows the same pattern as MeHg on a temporal basis.

3.1.2 Main Division

Methyl mercury concentrations along the Main division seemed to follow a similar pattern as observed in the North division (Figure 7A, page 63). Generally higher methyl mercury concentrations were in the range of ~0.19 to 0.86 ng L^{-1} during the spring and summer 2005. In the fall and winter, concentrations tended to decrease for all sites with the exception of RR15, which increased slightly (from ~0.2 to ~0.28 ng L^{-1}). In comparison from May to August 2006, methyl mercury concentrations generally increased and were in the range of ~ 0.13 to ~0.6 ng L^{-1}.

RR21 yielded the highest concentrations of total mercury (THg) relative to the other sites sampled in the fall, late winter, spring 2006 and summer 2006 (Figure 7B, page 65).

Generally for all sites in June, mercury concentrations fell within the range of ~3.1 to 4.9 ng L^{-1}, but in July, there was a notable decrease with the exception of RR19 which showed an increase (from ~4.25 to 5.25 ng L^{-1}). In late summer to October, the total mercury concentrations for all sites increased with higher concentrations observed at upstream sites. Total mercury concentrations decreased (from ~4 to ~2 ng L^{-1}) in November to April; however, a steady increase is apparent from April to August (~2 to ~4.6 ng L^{-1}).

In late August, RR21 presented the highest percentage (~ 50 %) of total mercury as methyl mercury (Figure 7C, page 67). Generally for all sites, the highest concentrations fell within the range of ~7 to 50% and were present during the summer. The percentages (of total mercury as methyl mercury) decreased in the fall 2005 until early March 2006 (i.e., minimum contributions); the overall range is ~15 to ~4%. However, in the spring 2006, there was an observable percentage increase from ~6% to ~15%, suggesting increased THg as MeHg.

3.1.3 North + Main Division

The highest MeHg concentration for the North and Main Branch Division occurred in June 2005 and fell within a range of ~0.32 to 0.49 ng L^{-1} (Figure 8A, page 69). Generally for the spring 2005 and until early August, MeHg concentrations decreased (~0.43 to 0.1 ng L^{-1}). In contrast, a steady increase was apparent in the fall (~0.13 to 0.23 ng L^{-1}). However, MeHg concentrations appear consistent at an average of ~ 0.13 ng L^{-1} in late winter and spring 2006.

Maximum total mercury concentrations were observed during June 2005 and were within a range of ~2.72 to 3.64 ng L^{-1} (Figure 8B, page 71). During the summer 2005, THg concentrations decreased from an overall average of ~ 3 to 1 ng L^{-1}. Total mercury values generally increased during the fall; overall, the concentrations were within the range of ~ 1.6 to 2.75 ng L^{-1}. During the late winter, THg concentrations at RR7 increased (from ~ 1.1 to 3 ng L^{-1}) but decreased to about one-half (~ 1.6 ng L^{-1}) in May 2006. Thus, no pattern is observed for THg.

As shown in Figure 8C (page 73), the percentages of THg as MeHg for RR12 and RR13 generally decreased from June 2005 to October 2005. RR7 exhibited the highest percentage (~33%) of total mercury as methyl mercury in mid-July 2005; the percentage dropped to ~9% in early August, and almost doubled (~ 16%) by late August. In early fall, the THg as MeHg percentage was ~7.6% and in February increased (~11%). Lower values were observed in March (~4.5%) and May 06 (~6.8%).

3.1.4 Composite Division

Figure 9A (page 75) shows methyl mercury (MeHg) concentrations for RR6. During the summer 2005, MeHg concentrations generally decreased from ~ 0.28 to ~0.14 ng L^{-1}. However, during the fall, MeHg concentrations increased from ~0.18 to 0.20 ng L^{-1}. In the late winter, the averaged concentration was ~0.14 ng L^{-1}. MeHg concentrations increased from March to May 2006 and decreased in June 2006, and were in the range of ~ 0.14 - 0.21 ng L^{-1}.

THg concentrations for RR6 are shown in Figure 9B (page 77). From June 2005 to August 2005, there is an apparent trend of decreased THg concentrations from ~1.26 - 0.65 ng L^{-1}. However, this trend appears reversed from August 2005 to March 2006 (~0.65 – 2.6

ng L^{-1}). In the spring 2006, THg concentrations were low and relatively stable, averaging ~1.4 ng L^{-1}. However, in the summer 2006, THg concentrations appear to increase.

Figure 9C (page 79) shows the percentage of total mercury (THg) as methyl mercury (MeHg) for RR6. From June 2005 to mid-July 2005, the percentage of THg as MeHg increased from ~21% to 28 %. However, an opposite effect was observed from August 2005 to March 2006 where values decreased from ~ 21% to 5 %. Decreased percentages appear to persist for RR6 in the spring 2006.

3.1.5 South Division

Figure 10A (page 81) shows methyl mercury concentrations for 5 sites comprising the South Division. Patterns and trends are more difficult to assess and identify since not all sites were sampled regularly. In general for June 2005 the MeHg concentrations for all sites were elevated and were within a range of ~0.22 to 0.54 ng L^{-1}. RR2 was sampled more regularly than other sites, and it exhibited the highest methyl mercury concentration of ~0.68 ng L^{-1} which occurred in August 2006. Overall RR2 MeHg concentrations decreased in the summer (within a range of ~ 0.24 to 0.08 ng L^{-1}), and increased in the fall (from ~0.10 to ~0.26 ng L^{-1}); there is also an apparent decrease in RR2 MeHg concentrations in the winter an effect which extended into spring, while in the summer the concentrations seem to increase. RR3 MeHg concentration levels appear to be decreasing continuously from summer 2005 to spring 2006.ff. RR1 concentrations appear to increase in the spring within a range of ~0.02 to 0.2 ng L^{-1}. RR4 yielded average concentrations of ~0.2 ng L^{-1} over the summer and fall 2005, the period for which sampling occurred. RR5 MeHg concentrations appeared relatively constant in the summer 2005 (at ~0.16 ng L^{-1}) and peaked slightly in

November 2005, then decreased in the winter and late spring 2006; this was followed by an increase in the summer 2006. Overall, RR5 MeHg concentrations were in the range of ~0.03 to 0.55 ng L^{-1}.

Total mercury (THg) concentrations are shown in Figure 10B (page 83). RR3 THg concentrations appear to increase almost linearly in the range of ~0.8 to 3.0 ng L^{-1} for sampling times beyond summer 2005. RR4 THg concentration decreased over the summer in the range of ~3.9 to 1.0 ng L^{-1}, but increased in the fall to ~2.7 ng L^{-1} and then decreased in May 2006 to ~0.5 ng L^{-1}. A similar trend is observed for RR2, the THg concentrations showed an initial rapid decrease in the summer (from ~3.9 ng L^{-1} to 0.4 ng L^{-1}), followed by a small increase to ~1.5 ng L^{-1} in the fall, and a subsequent decrease in the spring 2006 at ~0.8 ng L^{-1}. For RR1 the THg concentrations appear to increase in the summer (in the range of ~0.8 to 6.8 ng L^{-1}) and decrease in the fall (to ~1.4 ng L^{-1}), an effect which extends into spring 2006. For RR5 concentrations showed a rapid decrease from June 2005 to July 2005 (~1.95 - 0.24 ng L^{-1}) followed by an almost linear increase which peaked at 3.54 ng L^{-1} in November 2005. The THg concentration levels then decreased over the winter 2006 until late spring 2006 when levels began to increase again; overall, the THg concentrations for RR5 were within the range of ~0.24 – 3.54 ng L^{-1}.

Figure 10C (page 85) shows the percentage of total mercury as methyl mercury. As observed, RR1 percentages decreased in the summer from ~28% to 3.0%), increased in the fall to ~ 19% and then decreased in the spring 2006 to ~10%. In contrast, RR2 percentage of THg as MeHg increased to a maximum of ~62% in early summer which decreased rapidly toward the late summer; however, there is a noticeable increase in the fall from ~8% to 18%

then the percentages basically decreased until May 2006 approaching ~ 4%. RR3, RR4 and RR5 showed similar trends as RR2 but overall the percentage values were lower.

The preceding observations and measured data are representative for the South branch at the time of sampling. However, it is generally known that water is taken at times from the St Lawrence River and directed into the Raisin at the South Branch, but the amount is not quantified (Ridal, 2007) and could not be taken into consideration in the measured data. Thus, the findings for the South Branch cannot be generalized for subsequent seasons. Due to the assessment of hydrograph ratios presented, a comparison of daily discharges from 1991 to 1996 at Water Survey of Canada Station located at Long Sault, the mouth of the South Branch, demonstrates that annual averages ratio fluctuates significantly (Appendix A, page 225).

3.2 Overview of Nutrient Results in the 5 Divisions of the Raisin River

3.2.1 Nitrate

Nitrate concentrations varied considerably for the 5 Divisions in the Raisin River (Figure 11A-E, pages 87-95). Overall, the concentration ranged from below detection limit to ~2575 $\mu g\ L^{-1}$. For all Divisions elevated concentrations occurred in the fall 2005 during the October sampling, but were found to decrease in the winter. Except for the South Division, high concentrations, though lower than those of fall 2005, were observed in both June 2005 and late-May 2006. Characteristic of the summer 2005, nitrate concentrations were < 200 $\mu g\ L^{-1}$ for most sites. In the spring 2006 several downstream sites demonstrated the highest concentrations: RR16 in the North Division; RR15 in the Main Division, RR6 in the Composite Division and RR5 in the South Division.

3.2.2 Ammonia

Ammonia concentrations ranged from below the detection limit to 263 $\mu g\ L^{-1}$ for all Divisions of the Raisin River (Figure 12A-E, pages 97-105). For the South Division, ammonia concentrations peaked in June 2005 at ~263 $\mu g\ L^{-1}$ at site RR1; additionally, a minor concentration increase was observed in March 2006 at ~105 $\mu g\ L^{-1}$ at RR5 and levels decreased to <50 $\mu g\ L^{-1}$ for the remainder of the sampling event. Similarly for the March 2006 sampling, the North + Main, Composite, North and Main Divisions showed a peak ammonia concentration at RR7, RR6, RR16, and R15 sites, respectively; these sites are the most downstream in the respective Divisions.

3.2.3 Total Phosphorus

Overall the total phosphorus concentration for all 5 Divisions of the Raisin River ranged from below detection limit to 162 $\mu g\ L^{-1}$ (Figure 13A-E, pages 107-115). The general trend is that the highest concentrations occurred during June 2005 and summer 2005 for North, South and North + Main Divisions. For all Divisions those concentrations generally decrease until the fall when values were lowest. For the Composite, North, Main and South the concentrations essentially remained low for winter and spring 2006, and increased levels resulted in summer 2006. Downstream sites for all Divisions except North + Main and South show high total phosphorus concentrations relative to other sites.

3.2.4 Sulphate

Overall for the 5 Divisions comprising the Raisin River sulphate concentrations ranged from ~3 to 21.3 $mg\ L^{-1}$ (Figure 14A-E, pages 117-125). For the North + Main, Main, and North Divisions, the sulphate concentrations were relatively constant in June 2005 and summer 2005. During the fall, there were slightly elevated concentration values for the October sampling period observed for those Divisions. Sulphate concentrations were lowest in the late winter, but increases were apparent from March to May 2006. However, this trend was not apparent for the South and Composite Divisions, instead the highest sulphate concentrations occurred in the summer 2005 and spring 2006, while the lowest values occurred in the fall/winter. Trends in sulphate concentration of downstream sites were not apparent.

3.2.5 DOC

Overall the DOC among all Divisions of the Raisin River ranged from 3 (this would be typical of St. Lawrence River water) to 39 mg L^{-1} (Figure 15A-E, pages 127-135). All except the South Division followed the same temporal pattern. DOC concentrations were higher at the upstream sites relative to downstream. Generally, during June 2005 and summer 2005 concentrations in the Main and North Divisions were within the domain of ~17 to 38 mg L^{-1}, whereas for the North + Main and Composite Divisions corresponding values were between ~15 to 20 mg L^{-1} and ~13 to16 mg L^{-1}, respectively. For all Divisions DOC concentrations decreased during the fall, an effect that is less noticeable in the South Division; the lowest concentration (~ 4 mg L^{-1}) occurred in the late winter. In general there appears to be a gradual increase in DOC during the spring/summer 2006 for all Divisions except for North + Main.

3.2.6 DIC

DIC ranged from ~13 to 60 mg L^{-1} for all 5 Divisions of the Raisin River (Figure 16A-E, pages 137-145). Overall the Composite and North + Main Divisions tended to yield on average ~ 45 mg L^{-1} with the lowest concentrations (~22 mg L^{-1}) occurring in later winter. Overall from June 2005 to August 2006 a small linear increasing concentration trend is apparent for the South Division. For the North and Main Divisions, DIC concentrations tended to increase in the summer 2005, but such concentration appeared to have decreased in the fall and virtually remained constant in the winter and spring 2006. For the Main Division the downstream site (RR15) yielded higher concentrations from the fall to summer 2006; a similar observation was noted for the North Division downstream site (RR16) during the same period. No trend is apparent for the North + Main and South Divisions.

3.2.7 Specific Conductivity

Specific conductivities are plotted for the 5 Divisions in Figure 17A-E (pages 147-155). For the Main Division, the concentration profile appears to increase linearly from spring 2005 and peak at about midsummer 2005, then decrease until late winter 2006, followed by another linear increase throughout the spring 2006. The measurement values appear to fall within a rather wide domain with lower and upper bounds of ~175 to 550 μS cm^{-1}, respectively. A similar pattern is apparent in decreasing order for the North, Composite and North +Main Divisions. Correspondingly, the domain of measured values were ~300 to 850 μS cm^{-1} for the North Division; ~ 300 to 600 μS cm^{-1} for the Composite Division; and ~280 to 500 μS cm^{-1} for the North + Main Divisions. For the South Division the measured values are randomly distributed within a domain of ~ 320 to 800 μS cm^{-1} and no trend is apparent.

3.2.8 Dissolved Oxygen

Dissolved oxygen concentrations are plotted in Figure 18 A-E (pages 157-165) for the 5 Divisions comprising the Raisin River. The concentration profiles appear similar to those for the specific conductivity measurements described earlier.

Thus for the North Division, the concentration profile appears to decrease linearly from spring 2005 to reach a minimum at about midsummer 2005, then increase over the fall period and reach a maximum at about late winter 2006, followed by decrease throughout the spring 2006. The dissolved oxygen concentrations appear to fall within a rather wide domain having lower and upper bounds of ~2.4 and 13.6 mg L^{-1}, respectively. A similar pattern is apparent in decreasing order for the Main, North + Main, Composite and South Divisions. Correspondingly, the domain of dissolved oxygen concentrations were ~2.8 to 13.0 mg L^{-1} for the Main Division; ~ 5.0 to 13.6 mg L^{-1} for the North + Main Division; ~3.0 to 13.0 mg L^{-1} for the Composite Division; and ~ 4.2 to 13.0 mg L^{-1} for the South Division.

3.2.9 Saturation of Dissolved Oxygen

The percentage saturation of oxygen (Figures 19 A-E, pages 167-175) generally demonstrated the same seasonal trends for the North, Main, North + Main, and Composite Divisions. From June 2005 to early August decreased percentages occur and were within the range of ~20-85%. Percentages increased from late August 2005 until February2006, followed by a slight decline in early March 2006; a noticeable increase occurred in May

2006, subsequently thereafter the results remained relatively constant. This trend was most dominant for the North Division and decreased in order for the Main, Composite, and North + Main Divisions. For the South Division percentages generally fell within the range of ~ 47 to 150%; however, RR1, RR4 and RR5 exhibited a linear increase in the sampling period from fall 2005 to spring 2006.

3.3 Overview of Statistically Significant Results in the 5 Divisions of the Raisin River

3.3.1 Kruskal-Wallis Statistics

Kruskal-Wallis statistical analyses were applied to determine temporal and spatial relationships of mercury and nutrients in the 5 Divisions. Results are summarized in Table 3 (page 51).

There were a few cases in which temporal significance was demonstrated for the Divisions comprising the Raisin River. This occurred when analyses were conducted on the percentage of total mercury as methyl mercury, ammonia, nitrate, total phosphorus, DOC, and DIC all with probability values of less than $p= 0.05$ for all Divisions, except the Composite Division. There were other cases demonstrating a temporal significance: Methyl mercury demonstrated temporal significance among the Main, North and South Divisions. Similarly, total mercury temporal significant results occurred for the Main and South Divisions. Sulphate temporal significances did occur for the Main, North, and North + Main Divisions. Dissolved oxygen temporal significant findings were observed for all Divisions, except the Composite Division. Regarding specific conductivity, temporal significance did occur among the North, Main, and North + Main Divisions.

Only the South Division demonstrated spatial significance for nitrate, while only the Main Division demonstrated spatial significance among sites in respect of total phosphorus, specific conductivity, and DIC. Spatial significance occurred among sites for the Main and North Divisions of the river for DOC. None of the 5 Divisions showed statistical spatial significance for dissolved oxygen.

3.3.2 Spearman Correlation Analyses

Spearman correlation analyses were conducted to determine correlation relationships between mercury and nutrients, including dissolved oxygen and specific conductivity for all 5 Divisions of the Raisin River. Results are summarized in Table 4 (page 53).

Methyl mercury and total mercury demonstrated a significant positive correlation among the Main (p=0.026), North (p= 0.016), South (p= <0.001), and North + Main Divisions (p= 0.002). The Main Division demonstrated significant positive correlations between methyl mercury and ammonia (p= 0.010); methyl mercury and total phosphorus (p= 0.037); methyl mercury and sulphate (p= 0.010); methyl mercury and DOC (p= <0.001); total mercury and ammonia (p= 0.001); and total mercury and DOC (p= 0.023); total Hg and nitrate (p=0.023). A statistically significant negative correlation was demonstrated between total mercury and DIC (p= <0.001) for the Main Division. The North Division of the river demonstrated positive statistically significant correlations for several nutrient and mercury interactions: MeHg and ammonia (p=0.038); methyl mercury and total phosphorus (p= <0.001); methyl mercury and DOC (p= <0.001); methyl mercury and DIC (p= 0.004); and total mercury and DOC (p= 0.026). The South Division demonstrated positive correlations for several mercury and nutrient interactions: MeHg and nitrate (p=0.007);MeHg and TP (p=0.001); methyl mercury and ammonia (p= <0.001); total mercury and DOC (p= <0.001); THg and ammonia (p=0.002); THg and nitrate (p=<0.001); THg and TP (p=<0.001); and MeHg and DOC (p= <0.001). The Composite Division demonstrated positive significant correlation for total mercury and nitrate (p= <0.001); however a negative significant correlation was observed between total mercury and sulphate (p= 0.014). The North + Main Division demonstrated only positively correlated significant findings for methyl mercury and total phosphorus (p= <0.001) and methyl mercury and DOC (p= 0.022). The North, Main, and South Division demonstrated a significant negative correlation for methyl mercury when plotted against dissolved oxygen; apparently, this does not appear to be the case for total mercury and dissolved oxygen, since only the Composite Division demonstrated a positive significant correlation. Methyl mercury and specific conductivity showed a positive statistical significant correlation for the North Division, whereas, the Main and Composite divisions demonstrated significant negative correlations for total mercury and specific conductivity.

3.4 Yield Calculations

Yields were computed to determine sites along the river ecosystem responsible for high levels of nutrient, total or methyl mercury export. Using the data in Table 4 (page 53), pollutant correlations that showed positive or negative statistical relationship were selected to perform the yield calculations (and those that were not significant are presented in Appendix B (page 230)).

Yields for methyl mercury (MeHg), total mercury (THg), total phosphorus, sulphate, ammonia, nitrate, DOC, DIC, specific conductivity, and dissolved oxygen are presented in

Appendix B (Tables 1-5, pages 230-259) . Calculations are representative of several sites along the 5 Divisions comprising the Raisin River. For each site, the individual monthly yield was summed to provide a combined yield, representative of the sampling period (about a year). However, to facilitate better comparisons among the various sites, average yields were computed on the basis of readings taken only for those months in which sampling were common to all sites. In Tables 1-5 in Appendix B (pages 230-259), entries in the last row represent corrections of yield obtained at downstream sites relative to the upstream site.

Table 5 (page 55) shows average yields for mercury and several nutrients (Total Phosphorus, Nitrate, ammonia, DOC) for July and October 2005 and May 2006; all sites were sampled in these months. Generally at sites where MeHg and THg yields were highest, there were also high yields of total phosphorous, nitrate and DOC.

3.4.1 North Division

Tables 1A to 1G (Appendix B, page 230-234) show combined and averaged yields calculated for three sites, RR22 (most upstream), RR20 and R16 (furthest downstream) in the North Division.

The combined yields for methyl mercury (MeHg (Table 1A)), total mercury (THg (Table 1B), total phosphorus (Table 1D), DOC (Table 1G), and specific conductivity (Table 1G) decreased from the upstream site (RR22) to the downstream sites (RR20 and RR16). This decreasing effect is apparent upon comparison of the average yields.

For DIC (Table 1H) and dissolved oxygen (Table 1J), the combined yields decreased from the upstream site (RR22) to the mid-stream site (RR20) followed by an extremely low increase at site RR16, which, as in this case, becomes difficult to identify probable trend(s).

However by comparing the average yields a decreasing effect becomes apparent from the upstream to the downstream sites.

3.4.2 Main Division

Combined and averaged yields for contaminants representative of the Main Division are summarized in Tables 2A to 2I (Appendix B, pages 235-244).

The combined yields for MeHg (Table 2A) and THg (Table 2B) showed a decrease from the upstream site (RR21) to the mid-stream site (RR17) followed by an increase at the downstream site (RR15). An opposite effect is apparent when average yields are compared. Here values increase at the upstream site (RR21) to an intermediary downstream site (RR19), and then decrease at the most downstream site (RR15).

The combined yields for sulphate (Table 2C), DOC (Table 2G), and dissolved oxygen (Table 2J) decreased from the upstream site (RR21) to the downstream site (RR15); but for ammonia (Table 2F) an increased was observed at the downstream site (RR15). However, comparison of the average yields demonstrates that ammonia decreases from upstream to downstream sites. Average yields for sulphate, DOC, and dissolved oxygen increased from the upstream site (RR21) to an intermediary downstream site (RR19), followed by a general decrease toward the most downstream site (RR15).

Combined yields for DIC (Table 2H) present a rather complex profile: an increase at an upstream site (RR21) relative to a downstream site (RR19), then a decrease at downstream sites RR18 and RR17, followed by an increase from RR17 to the most downstream site (RR15). Average yields increase from the upstream site (RR21) to downstream site (RR19) followed by a decrease to the most downstream site (RR15).

Combined yields of total phosphorus (Table 2D) and specific conductivity (Table 2I) show an increased from the upstream site (RR21) to a downstream site (RR19) and decreased thereafter to the most downstream site. This trend is supported by a comparison of the average yields.

3.4.3 North + Main Division

Tables 3 A-G (Appendix B, pages 244-249) show the combined and average yields for pollutants reflective of the North + Main Division.

Combined yields for MeHg (Table 3A), sulphate (Table 3C), DOC (Table 3G), and specific conductivity (Table 3I) decreased from the upstream site (RR13) to a downstream site (RR12) followed by an increase at the most downstream site (RR7). By comparison, the average yields demonstrate a decrease from an upstream site (RR13) to a downstream site (RR7).

Combined yields for total phosphorus (Table 3D) and THg (Table 3B) demonstrated a decrease from the upstream site (RR13) to the downstream site (RR7). A comparison of the average yields supports this trend.

Combined yields of nitrate (Table 3E) show an increase from the upstream site (RR13) to midstream site (RR12), followed by a decrease from (RR12) to the most downstream site (RR7). This trend appears consistent when the average yields were considered.

3.4.4 Composite Division

Combined and average yields for the Composite Division are summarized in Tables 4A to 4J (Appendix B, pages 249-254). The combined yields for MeHg, THg, total phosphorus, nitrate, DOC, DIC, specific conductivity, and dissolved oxygen demonstrated a decrease from the upstream site (RR5) to the downstream site (RR6). This trend is apparent when average yields were examined for all the pollutants.

3.4.5 South Division

Tables 5A to 5E (Appendix B, pages 254-259) show a summary of yield calculations for the South Division for all pollutants.

The combined yields demonstrated a decrease from the upstream site (RR1) to the downstream site (RR4) for contaminants MeHg, THg, DOC, and dissolved oxygen. Comparison of the average yields demonstrated the same trend for all pollutants.

The combined yields for ammonia showed a decrease from the upstream site (RR1) to a downstream site (RR3) followed by an increase at the most downstream site (RR4). However, comparison of the averaged yields shows a decreasing trend from upstream to downstream sites.

Table 3. Summary results of Kruskal-Wallis statistical analyses applied to measured data reflective of site and seasonal parameters for the 5 Divisions of the Raisin River.

Materials/ Properties of Interest	Parameter	Raisin River Divisions				
		North	Main	North + Main	Composite[a]	South
Methyl Mercury	Sites	p= 0.421 n= 39[b]	p= 0.218 n= 52	p= 0.328 n= 19		p= 0.998 n= 49
	Seasons	p=<0.001 * n= 39	p=<0.001 * n= 52	p= 0.079 n= 19	p= 0.287 n= 12	p=<0.001 * n= 49
Total Mercury	Sites	p= 0.091 n= 38	p= 0.171 n=51	p= 0.230 n= 21		p= 0.800 n= 49
	Seasons	p= 0.156 n= 38	p= 0.021 * n= 51	p= 0.104 n= 21	p= 0.135 n= 12	p=<0.001 * n= 49
% of Total as Methyl Hg	Sites	p= 0.987 n= 38	p= 0.774 n= 51	p= 0.874 n= 19		p= 0.748 n= 48
	Seasons	p=<0.001 * n= 38	p=<0.001 * n= 51	p= 0.034 * n= 19	p= 0.069 n= 12	p= 0.001 * n= 48
Ammonia	Sites	p= 0.500 n= 40	p= 0.082 n= 52	p= 0.970 n= 21		p= 0.824 n= 49
	Seasons	p= 0.001 * n= 40	p= 0.001 * n= 52	p= 0.010 * n= 21	p= 0.319 n= 12	p=<0.001 * n= 49
Nitrate	Sites	p= 0.361 n= 40	p= 0.444 n= 52	p= 0.846 n= 21		p=0.014 * n= 49
	Seasons	p= 0.003 * n= 40	p=<0.001 * n= 52	p= 0.020 * n= 21	p= 0.100 n= 12	p= 0.002 * n= 49
Total Phosphorus	Sites	p= 0.258 n= 40	p= 0.002 * n= 52	p= 0.233 n= 21		p= 0.510 n= 49
	Seasons	p=<0.001 * n= 40	p= 0.029 * n= 52	p= 0.010 * n= 21	p= 0.069 n= 12	p= 0.006 * n= 49
Sulphate	Sites	p= 0.398 n= 40	p= 0.259 n= 52	p= 0.900 n= 21		p= 0.379 n= 49
	Seasons	p= 0.019 * n= 40	p= 0.001 * n= 52	p= 0.014 * n= 21	p= 0.360 n= 12	p= 0.880 n= 49
DOC	Sites	p= 0.005 * n= 40	p=<0.001 * n= 52	p= 0.166 n= 21		p= 0.948 n= 49
	Seasons	p= 0.001 * n= 40	p= 0.001 * n= 52	p= 0.003 * n= 21	p= 0.325 n= 12	p=<0.001 * n=49
DIC	Sites	p= 0.310 n= 40	p=<0.001 * n= 52	p= 0.944 n= 21		p= 0.503 n= 49
	Seasons	p=<0.001 * n= 40	p= 0.001 * n= 52	p= 0.004 * n= 21	p= 0.326 n= 12	p= 0.002 * n= 49

Table 3 (con't). Summary results of Kruskal-Wallis statistical analyses applied to measured data reflective of site and seasonal parameters for the 5 Divisions of the Raisin River.

Materials/ Properties of Interest	Parameter	Raisin River Divisions				
		North	Main	North + Main	Composite[a]	South
Dissolved Oxygen	Sites	p= 0.522 n= 35	p= 0.736 n= 48	p= 0.572 n= 21		p= 0.505 n= 43
	Seasons	p= <0.001* n= 35	p= <0.001* n= 48	p= 0.004* n= 21	p= 0.143 n= 12	p=<0.001* n= 43
Specific Conductivity	Sites	p= 0.994 n= 34	p= <0.001* n= 48	p= 0.991 n= 21		p= 0.147 n= 43
	Seasons	p= 0.001* n= 34	p= 0.025* n= 48	p= 0.014* n= 21	p= 0.084 n= 12	p= 0.635 n= 43

* Indicates statistically significant results, i.e., those that possess a p-value less than 0.05
[a]- Only seasonal analyses could be carried out for the Composite Division since only 1 site was present at that location.
[b]- **n** refers to the number of values utilized for each parameter and Division.

Table 4. Summary results of Spearman correlation analyses applied to measured data, reflective of mercury and nutrient interactions for all 5 Divisions of the Raisin River.

Interaction	Raisin River Divisions				
	North	Main	North + Main	Composite	South
MeHg vs. THg	r_s= 0.387[a] p= 0.016* n= 38[b]	r_s= 0.312 p= 0.026* n= 51	r_s= 0.663 p= 0.002* n= 19	r_s= -0.067 p= 0.838 n= 12	r_s= 0.554 p=<0.001* n= 49
MeHg vs. Ammonia	r_s= 0.333 p= 0.038* n= 39	r_s= 0.356 p= 0.010* n= 52	r_s= 0.417 p= 0.076 n= 19	r_s= -0.227 p= 0.476 n= 12	r_s= 0.667 p=<0.001 * n= 49
THg vs. Ammonia	r_s= 0.230 p= 0.164 n= 38	r_s= 0.435 p= 0.001* n= 51	r_s= 0.378 p= 0.091 n= 21	r_s= -0.014 p= 0.969 n= 12	r_s= 0.441 p= 0.002* n= 49
MeHg vs. Nitrate	r_s= -0.212 p= 0.195 n= 39	r_s= -0.167 p= 0.236 n= 52	r_s= 0.302 p= 0.208 n= 19	r_s= -0.194 p= 0.543 n= 12	r_s= 0.382 p= 0.007* n= 49
THg vs. Nitrate	r_s= 0.133 p= 0.429 n= 38	r_s= 0.319 p= 0.023* n= 51	r_s= 0.427 p= 0.053 n= 21	r_s= 0.881 p=<0.001* n= 12	r_s= 0.600 p=<0.001* n= 49
MeHg vs. Total P	r_s= 0.519 p=<0.001* n= 39	r_s= 0.290 p= 0.037* n= 52	r_s= 0.730 p=<0.001* n= 19	r_s= 0.290 p= 0.360 n= 12	r_s= 0.443 p= 0.001* n= 49
THg vs. Total P	r_s= 0.307 p= 0.060 n= 38	r_s= 0.048 p= 0.743 n= 51	r_s= 0.359 p= 0.109 n= 21	r_s= -0.490 p= 0.105 n= 12	r_s= 0.501 p=<0.001* n= 49
MeHg vs. Sulphate	r_s= 0.218 p= 0.182 n= 39	r_s= 0.353 p= 0.010* n= 52	r_s= 0.401 p= 0.090 n= 19	r_s= 0.025 p= 0.938 n= 12	r_s= 0.072 p= 0.626 n= 49
THg vs. Sulphate	r_s= -0.114 p= 0.495 n= 38	r_s= -0.031 p= 0.827 n= 51	r_s= 0.310 p= 0.172 n= 21	r_s= -0.685 p= 0.014* n= 12	r_s= 0.131 p= 0.373 n= 49
MeHg vs. DOC	r_s= 0.718 p=<0.001* n= 39	r_s= 0.683 p=<0.001* n= 52	r_s= 0.502 p= 0.022* n= 19	r_s= 0.451 p= 0.141 n= 12	r_s= 0.474 p=<0.001* n= 49
THg vs. DOC	r_s= 0.361 p= 0.026* n= 38	r_s= 0.318 p= 0.023* n= 51	r_s= 0.070 p= 0.760 n= 21	r_s= -0.482 p= 0.112 n= 12	r_s= 0.319 p= 0.025* n= 49
MeHg vs. DIC	r_s= 0.449 p= 0.004* n= 39	r_s= 0.209 p= 0.138 n= 52	r_s= 0.104 p= 0.673 n= 19	r_s= 0.321 p= 0.323 n= 12	r_s= -0.258 p= 0.074 n= 49

Table 4 (con't). Summary results of Spearman correlation analyses applied to measured data, reflective of mercury and nutrient interactions for all 5 Divisions of the Raisin River.

Interaction	Raisin River Divisions				
	North	Main	North + Main	Composite	South
THg vs. DIC	r_s= -0.288 p= 0.080 n= 38	r_s= -0.548 p=<0.001* n= 51	r_s= -0.271 p= 0.234 n= 21	r_s= -0.575 p= 0.051 n= 12	r_s= -0.200 p= 0.168 n= 49
MeHg vs. Dissolved Oxygen	r_s= -0.651 p= <0.001* n= 34	r_s= -0.499 p=<0.001* n= 47	r_s= -0.225 p= 0.371 n= 18	r_s= -0.387 p= 0.239 n= 11	r_s= -0.441 p= 0.003* n= 43
THg vs. Dissolved Oxygen	r_s= 0.043 p= 0.843 n= 32	r_s= 0.237 p= 0.108 n= 47	r_s= 0.108 p= 0.651 n= 20	r_s= 0.736 p= 0.010* n= 11	r_s= -0.164 p= 0.295 n= 43
MeHg vs. Specific Conducti-vity	r_s= 0.589 p=<0.001* n= 33	r_s= 0.096 p= 0.519 n= 47	r_s= 0.319 p= 0.196 n= 18	r_s= 0.461 p= 0.153 n= 11	r_s= -0.012 p= 0.937 n= 43
THg vs. Specific Conducti-vity	r_s= -0.283 p= 0.116 n= 32	r_s= -0.498 p=<0.001* n= 47	r_s= 0.031 p= 0.898 n= 20	r_s= -0.691 p= 0.018* n= 11	r_s= -0.131 p= 0.406 n= 43

* Indicates statistically significant results, those that possess a p-value less than 0.05

[a]- $\mathbf{r_s}$ refers to the Spearman correlation coefficient (a positive value means the two parameters being tested are related in a positive way, whereas a negative value means that they are negatively related).

[b]- **n** refers to the number of pair values for each interaction for each Division.

Table 5. Summary of average yields for mercury and several nutrients at all sites in the 5 Divisions of the Raisin River for July and October 2005 and May 2006.

Division	Site (Upstream to Downstream)	MeHg (ng m^{-2} $month^{-1}$)	THg (ng m^{-2} $month^{-1}$)	Total phosphorus (µg m^{-2} $month^{-1}$)	Nitrate (µg m^{-2} $month^{-1}$)	Ammonia (µg m^{-2} $month^{-1}$)	DOC (mg m^{-2} $month^{-1}$)
North	RR22	62.9×10^{-8}	57.7×10^{-7}	30.6×10^{-6}	105.0×10^{-5}	35.5×10^{-6}	46.6×10^{-6}
	RR20	19.1×10^{-8}	16.2×10^{-7}	7.31×10^{-6}	280×10^{-5}	12.7×10^{-6}	12.9×10^{-6}
	RR16	8.58×10^{-8}	8.62×10^{-7}	9.16×10^{-6}	14.9×10^{-5}	5.43×10^{-6}	6.09×10^{-6}
Main	RR21	79.5×10^{-8}	95.2×10^{-7}	17.3×10^{-6}	79.2×10^{-5}	66.7×10^{-6}	77.8×10^{-6}
	RR19	104.0×10^{-8}	114.0×10^{-7}	109.0×10^{-6}	146.0×10^{-5}	57.8×10^{-6}	78.9×10^{-6}
	RR18	29.5×10^{-8}	31.7×10^{-7}	37.4×10^{-6}	49.4×10^{-5}	14.9×10^{-6}	22.8×10^{-6}
	RR17	21.0×10^{-8}	23.1×10^{-7}	43.7×10^{-6}	30.5×10^{-5}	11.1×10^{-6}	15.2×10^{-6}
	RR15	10.9×10^{-8}	11.0×10^{-7}	15.4×10^{-6}	36.6×10^{-5}	7.61×10^{-6}	8.24×10^{-6}
North + Main	RR13	4.60×10^{-8}	5.84×10^{-7}	8.76×10^{-6}	12.7×10^{-5}	3.28×10^{-6}	3.31×10^{-6}
	RR12	3.99×10^{-8}	4.84×10^{-7}	7.73×10^{-6}	13.1×10^{-5}	4.27×10^{-6}	2.85×10^{-6}
	RR7	3.45×10^{-8}	3.61×10^{-7}	3.63×10^{-6}	2.93×10^{-5}	2.20×10^{-6}	2.67×10^{-6}
Composite	RR6	2.48×10^{-8}	2.13×10^{-7}	4.78×10^{-6}	7.76×10^{-5}	2.53×10^{-6}	1.74×10^{-6}
South	RR1	103.0×10^{-8}	53.8×10^{-7}	78.4×10^{-6}	130.0×10^{-5}	72.1×10^{-6}	34.3×10^{-6}
	RR2	31.7×10^{-8}	27.9×10^{-7}	70.6×10^{-6}	16.5×10^{-5}	33.4×10^{-6}	17.4×10^{-6}
	RR3	12.3×10^{-8}	25.1×10^{-7}	17.3×10^{-6}	28.7×10^{-5}	10.1×10^{-6}	8.86×10^{-6}
	RR4	8.21×10^{-8}	13.7×10^{-7}	22.9×10^{-6}	60.7×10^{-5}	9.28×10^{-6}	4.32×10^{-6}
	RR5	8.00×10^{-8}	8.15×10^{-7}	18.7×10^{-6}	35.6×10^{-5}	8.75×10^{-6}	3.87×10^{-6}

Figure 6A. Methyl mercury concentrations for the North Division from June 2005 to August 2006.

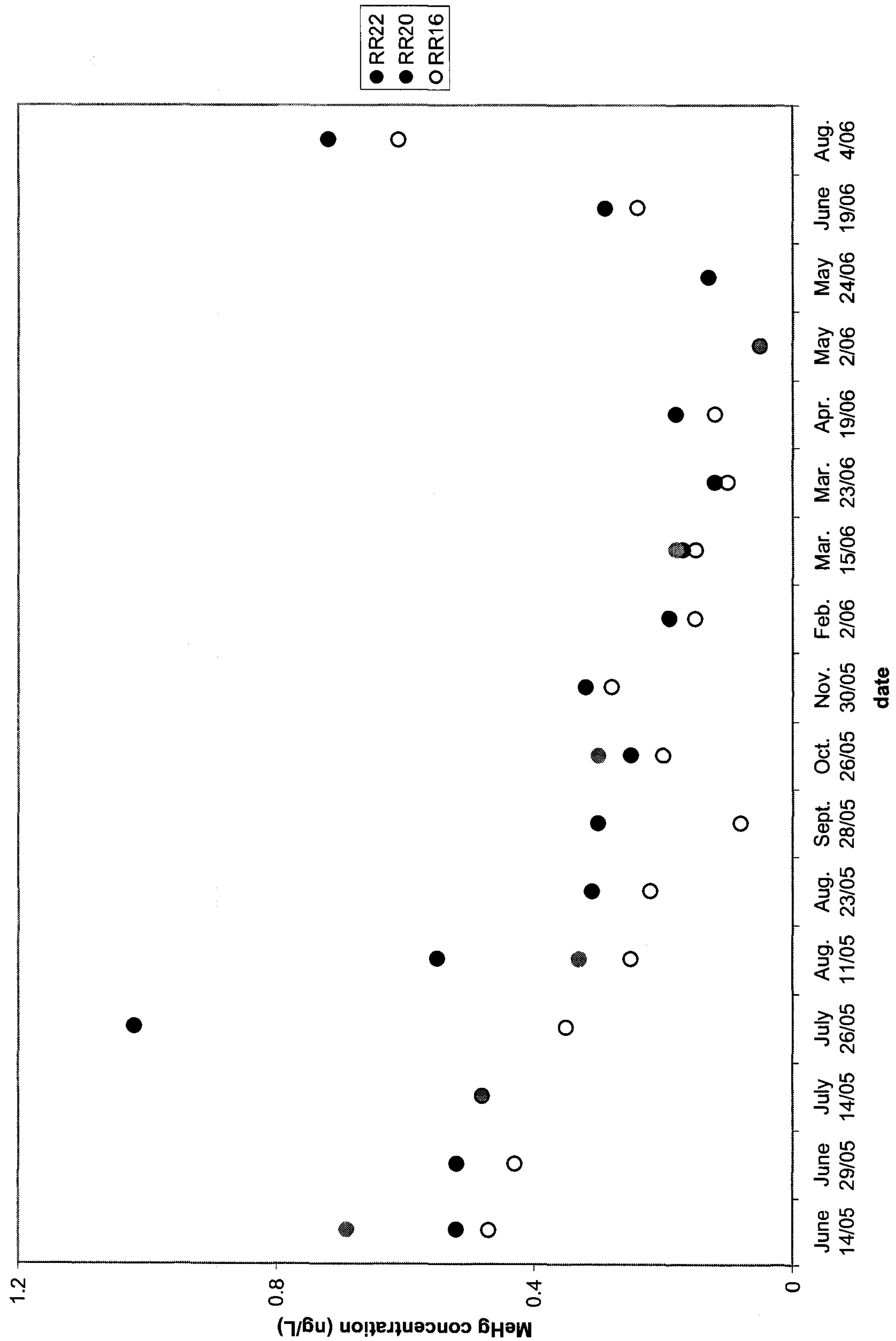

RR22
RR20
RR16
MeHg concentration (ng/L)
1.2
0.8
0.4
0
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 6B. Total mercury concentrations for the North Division from June 2005 to August 2006.

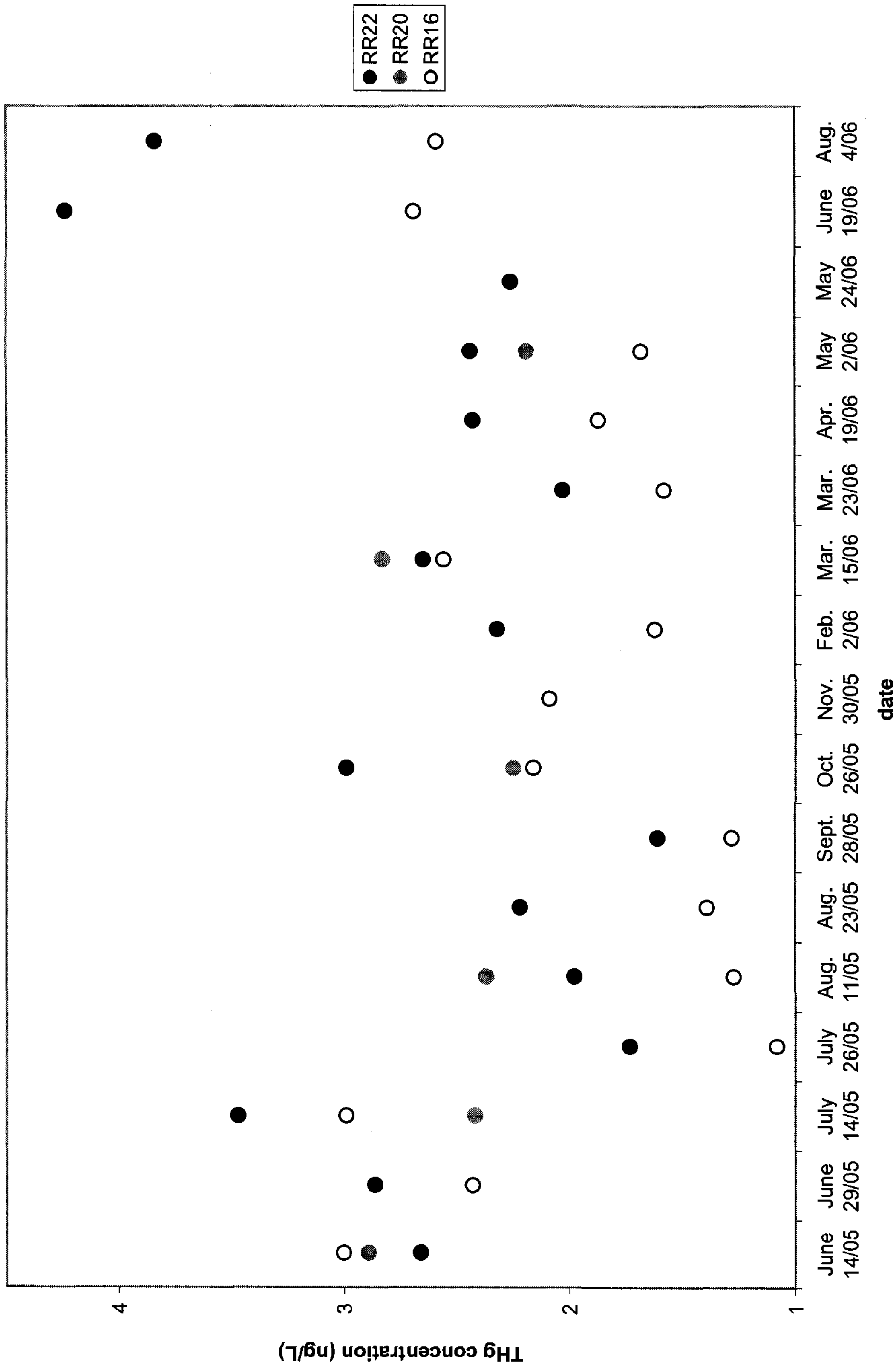

RR22
RR20
RR16
THg concentration (ng/L)
1
2
3
4
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 6C. Percentage of total mercury as methyl mercury for the North Division from June 2005 to August 2006.

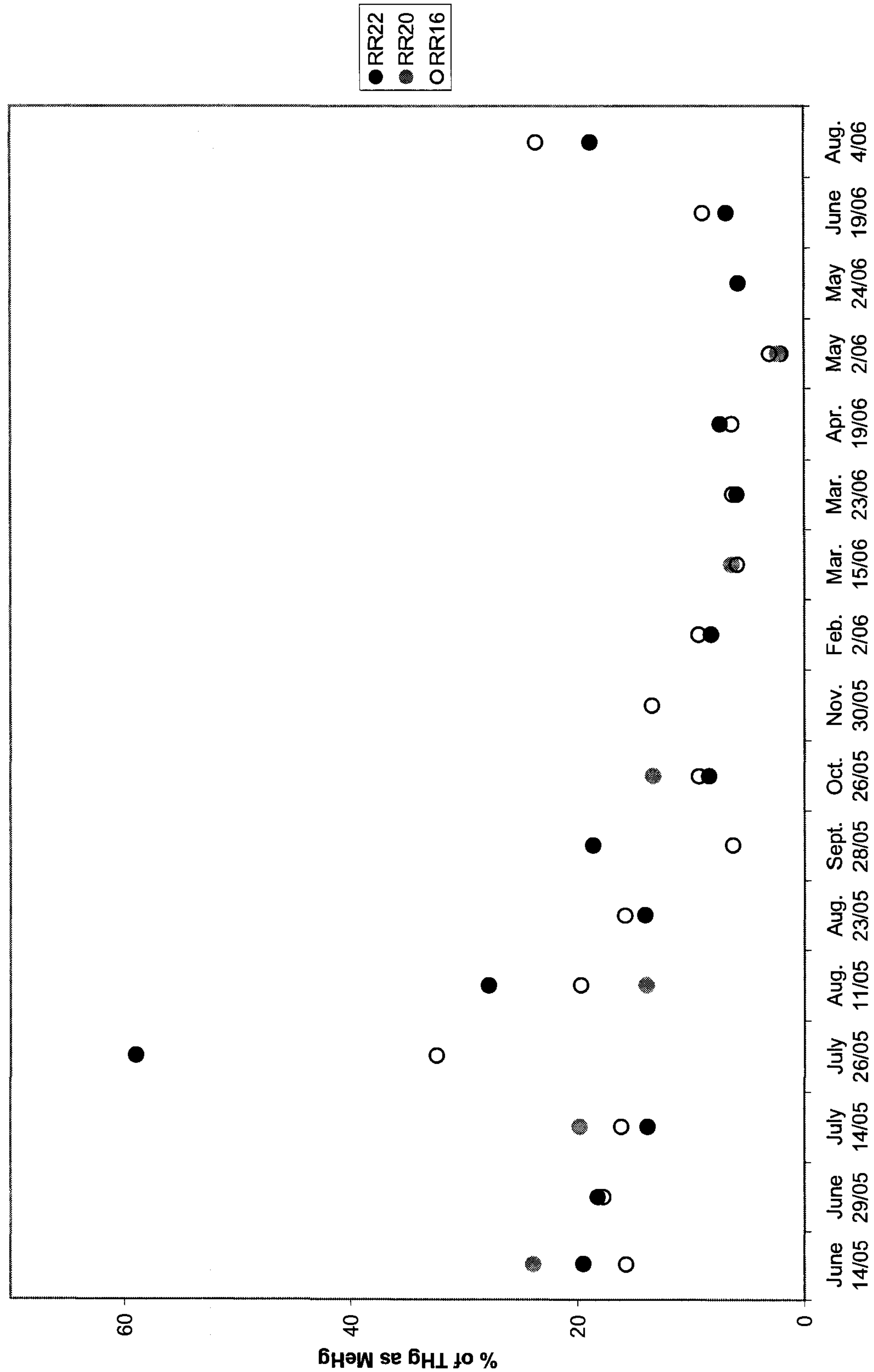

RR22
RR20
RR16
% of THg as MeHg
0
20
40
60
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 7A. Methyl mercury concentrations for the Main Division from June 2005 to August 2006.

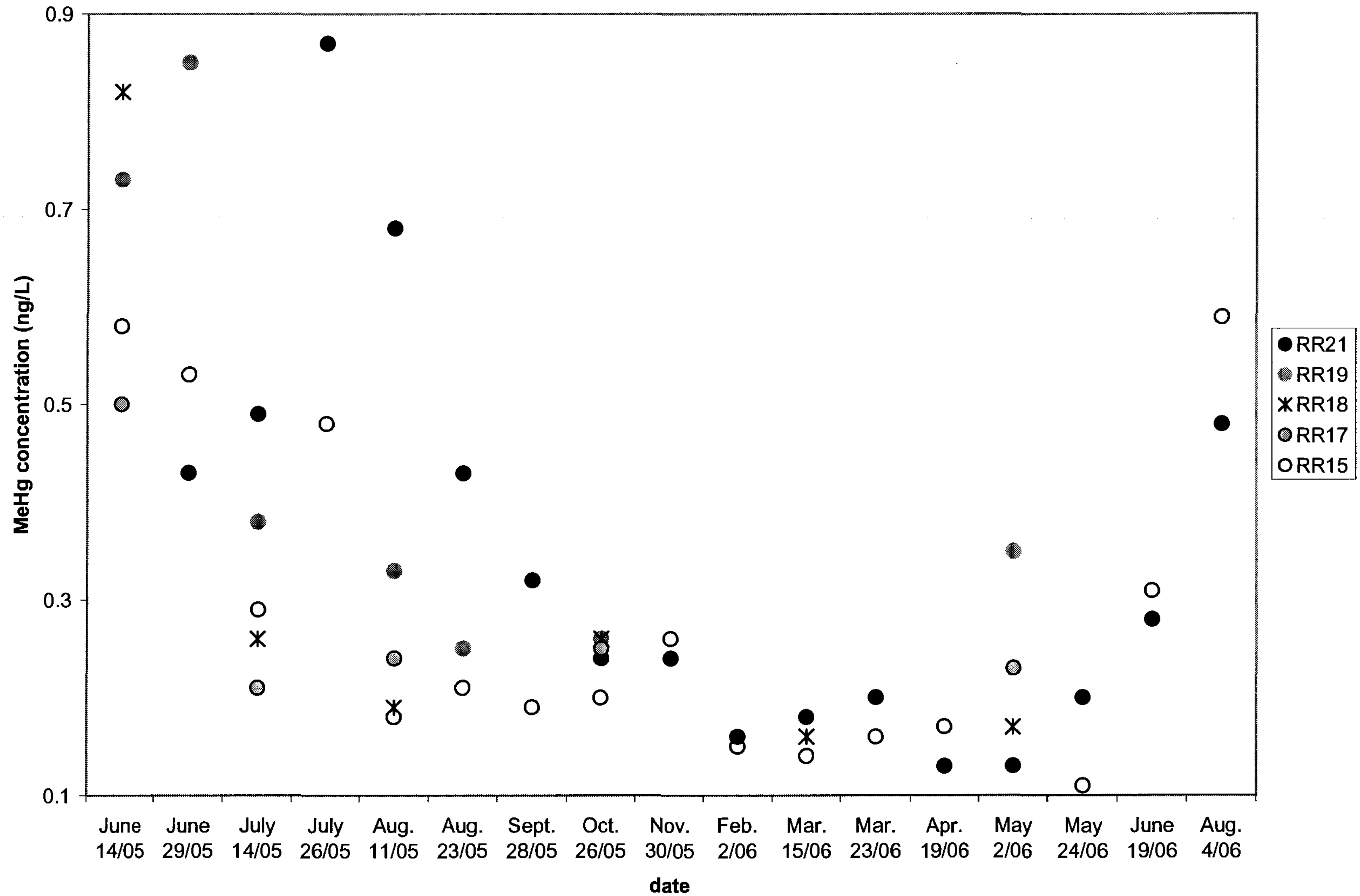

0.9
0.7
0.5
0.3
0.1
MeHg concentration (ng/L)
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date
RR21
RR19
RR18
RR17
RR15

Figure 7B. Total mercury concentrations for the Main Division from June 2005 to August 2006.

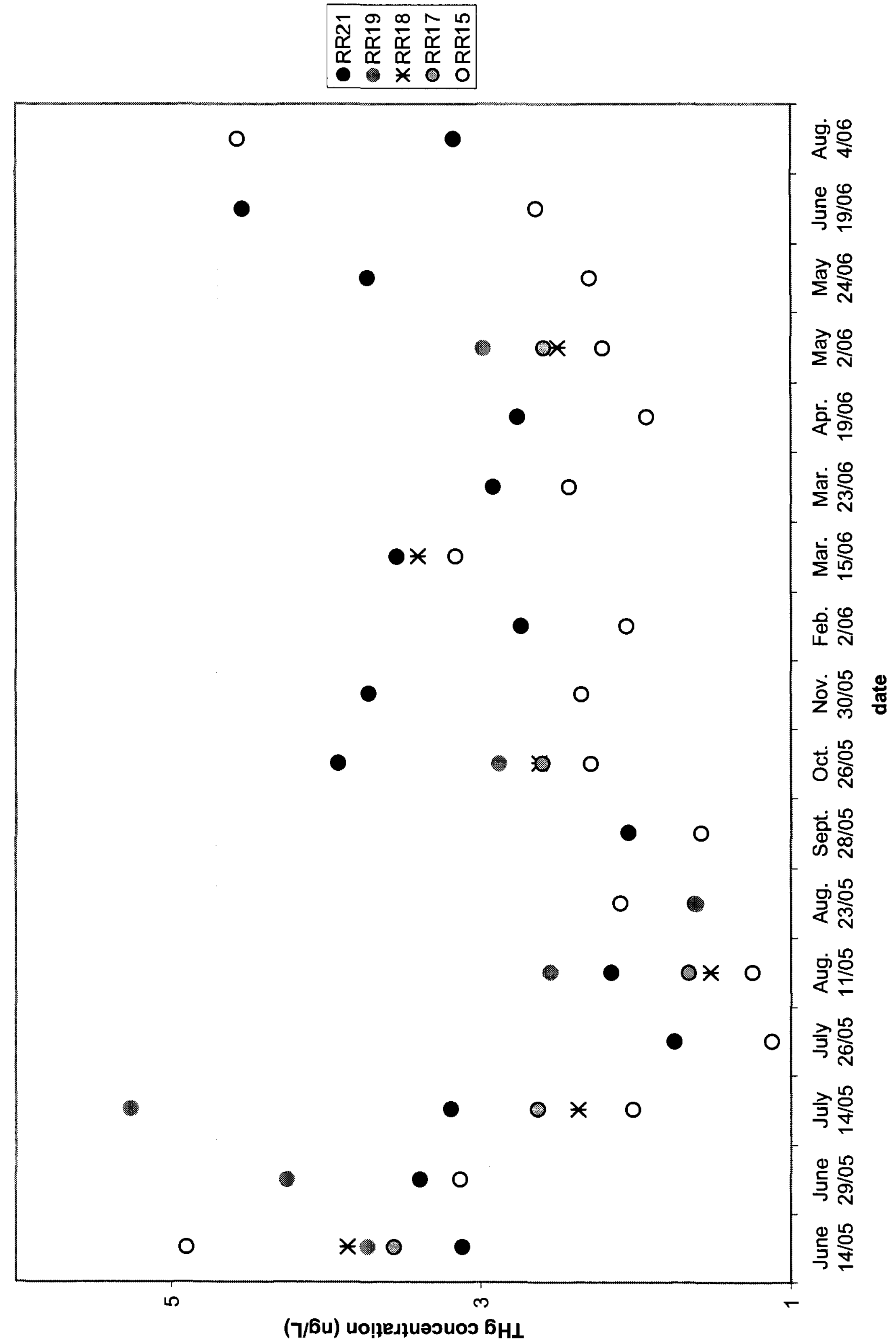

RR21
RR19
RR18
RR17
RR15
THg concentration (ng/L)
1
3
5
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 7C. Percentage of total mercury as methyl mercury for the Main Division from June 2005 to August 2006.

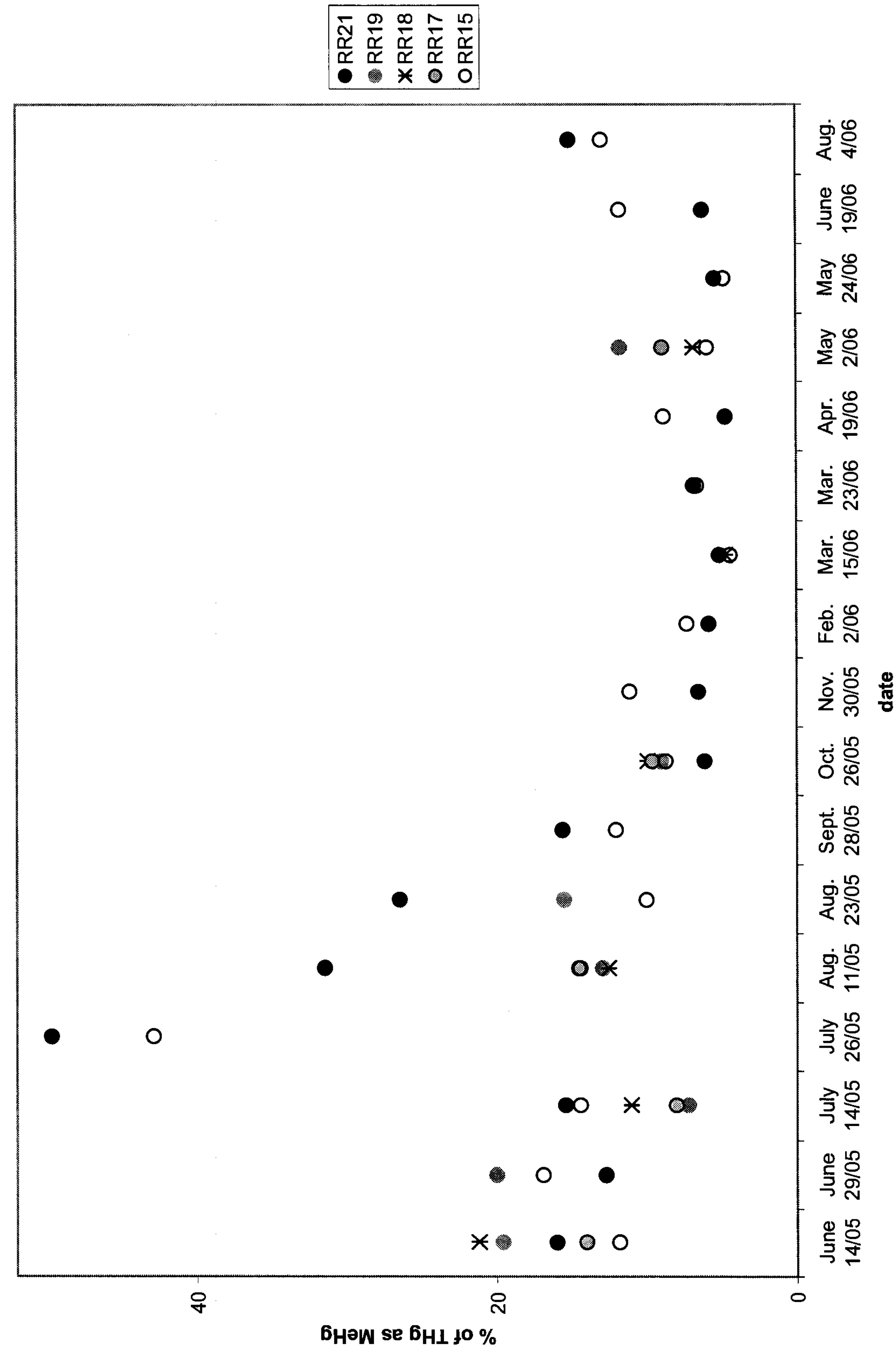
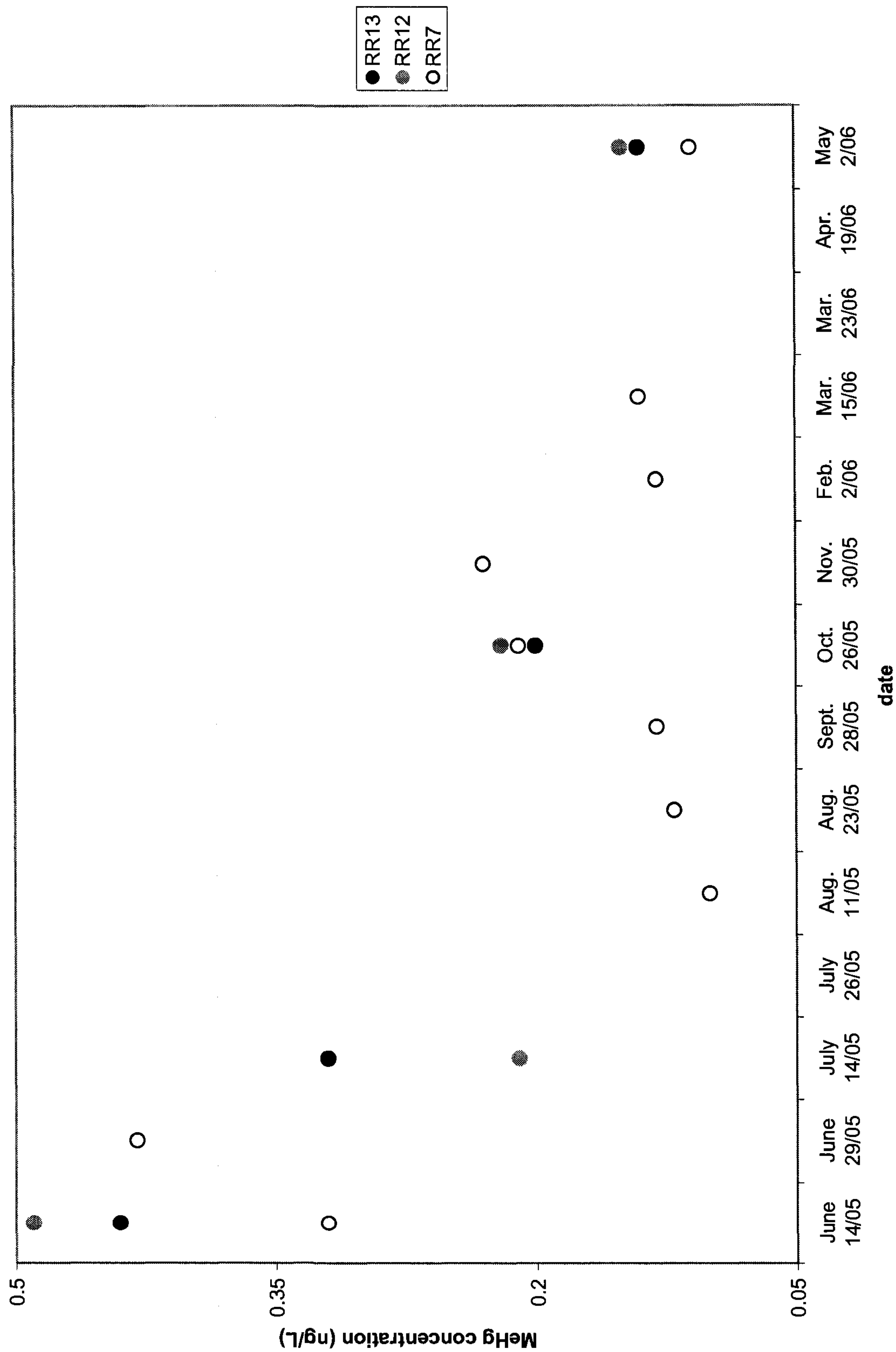
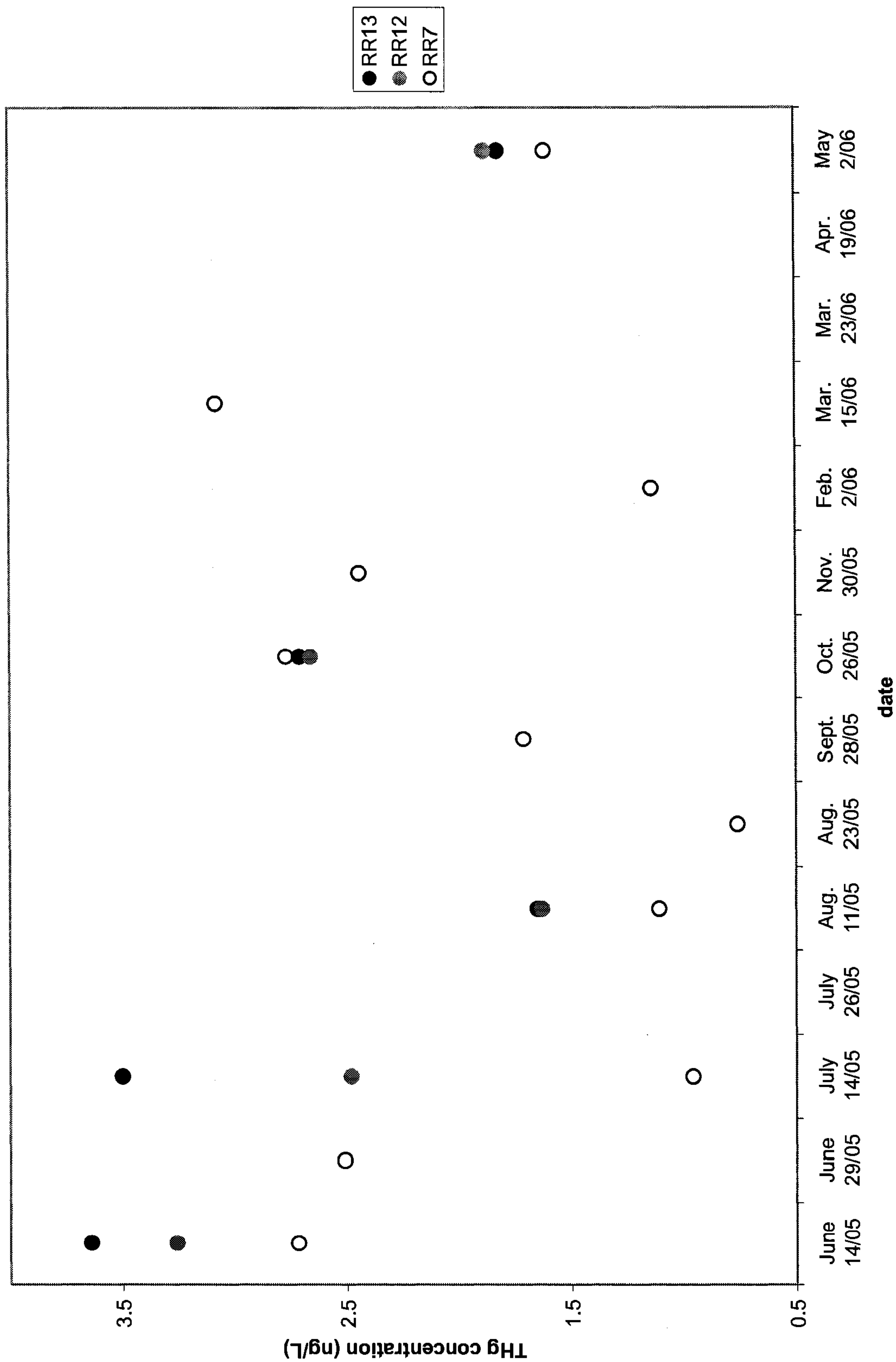

RR21
RR19
RR18
RR17
RR15
% of THg as MeHg
0
20
40
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 8A. Methyl mercury concentrations for the North + Main Division from June 2005 to May 2006.



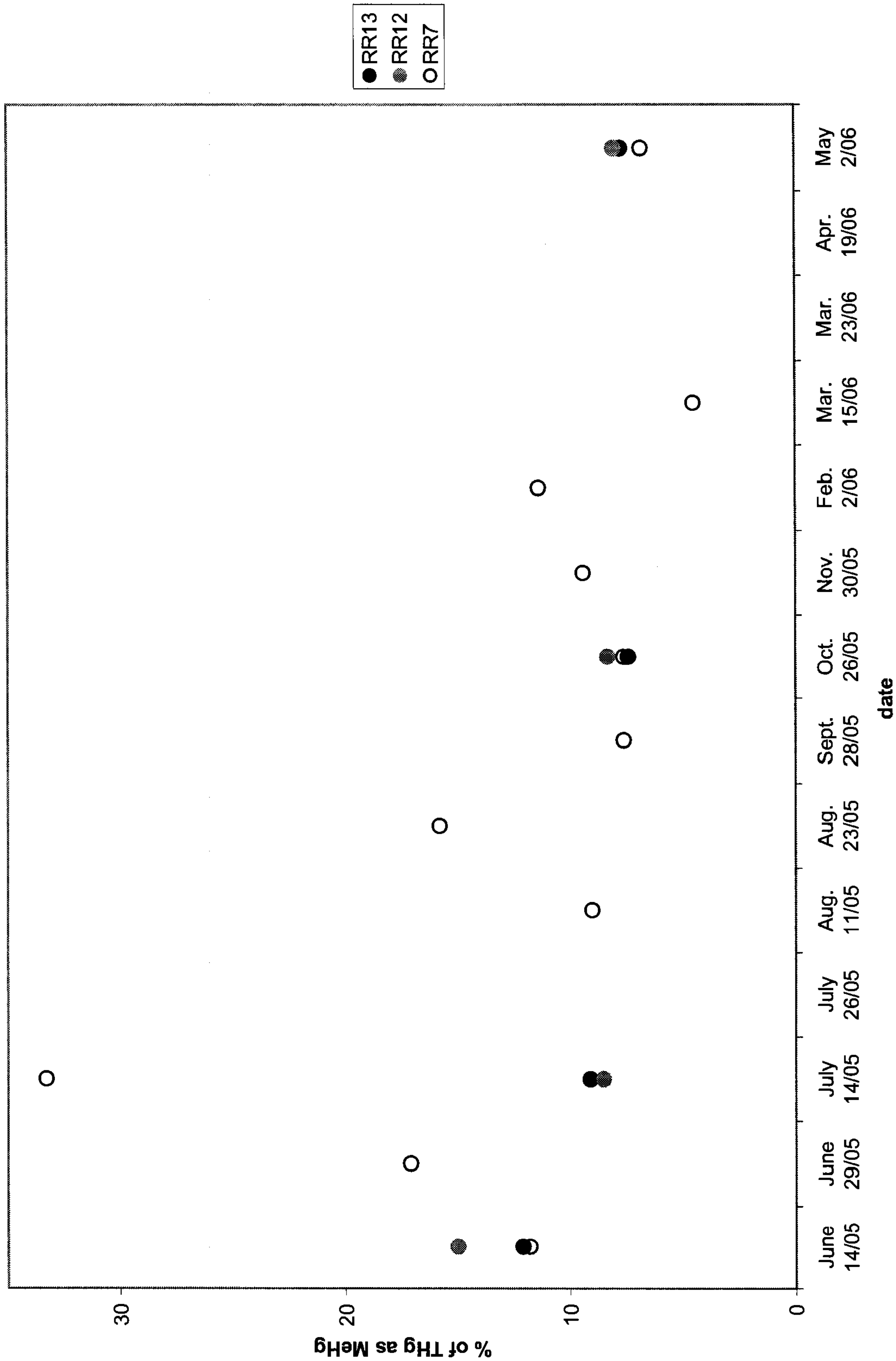
RR13
RR12
RR7
MeHg concentration (ng/L)
0.5
0.35
0.2
0.05
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06

Figure 8B. Total mercury concentrations for the North + Main Division from June 2005 to May 2006.



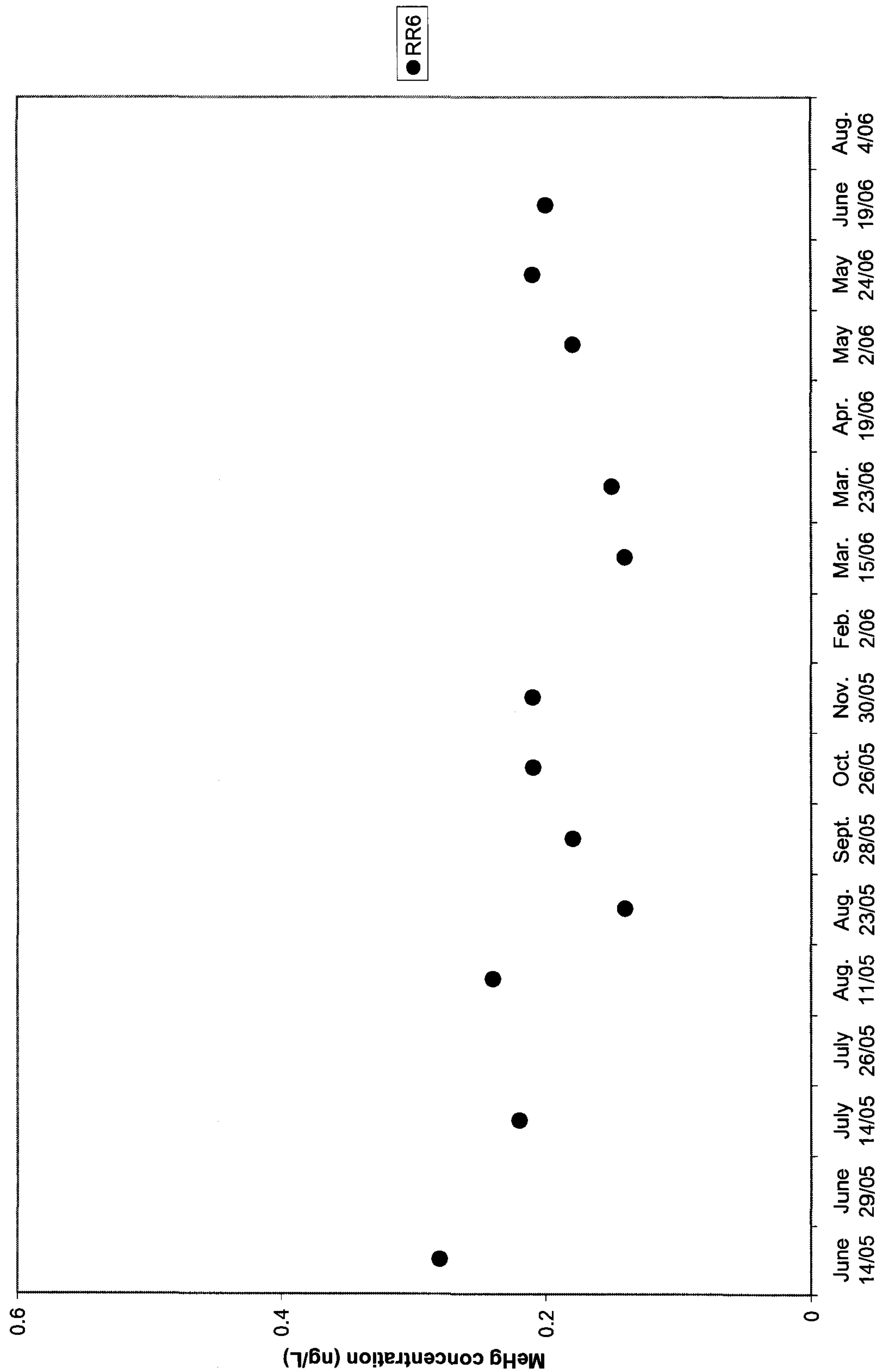
RR13
RR12
RR7
THg concentration (ng/L)
3.5
2.5
1.5
0.5
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06

Figure 8C. Percentage of total mercury as methyl mercury for the North + Main Division from June 2005 to May 2006.



RR13
RR12
RR7
% of THg as MeHg
0
10
20
30
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date

Figure 9A. Methyl mercury concentrations for the Composite Division from June 2005 to August 2006.



MeHg concentration (ng/L)
0.6
0.4
0.2
0
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
RR6

Figure 9B. Total mercury concentrations for the Composite Division from June 2005 to August 2006.

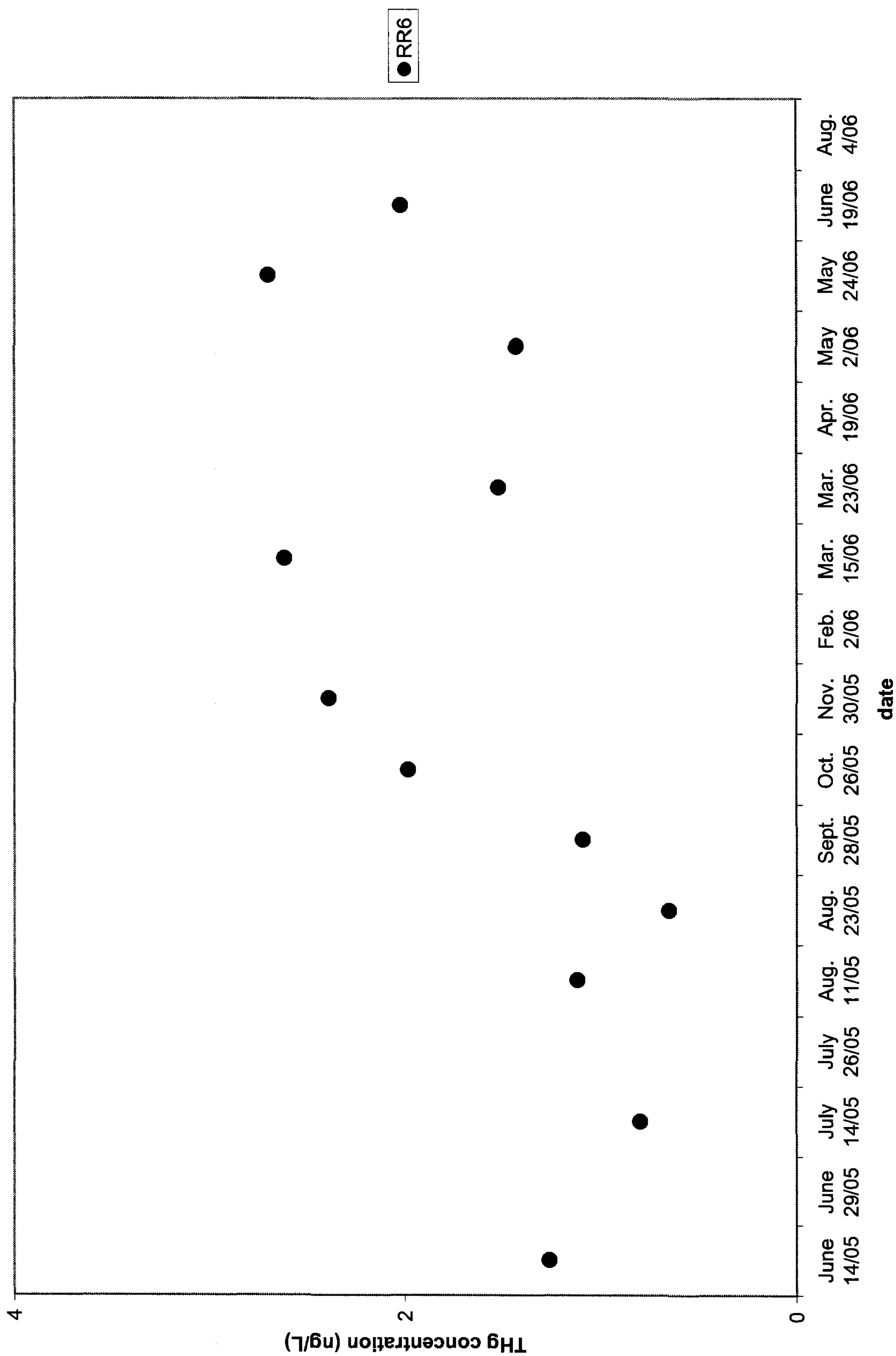
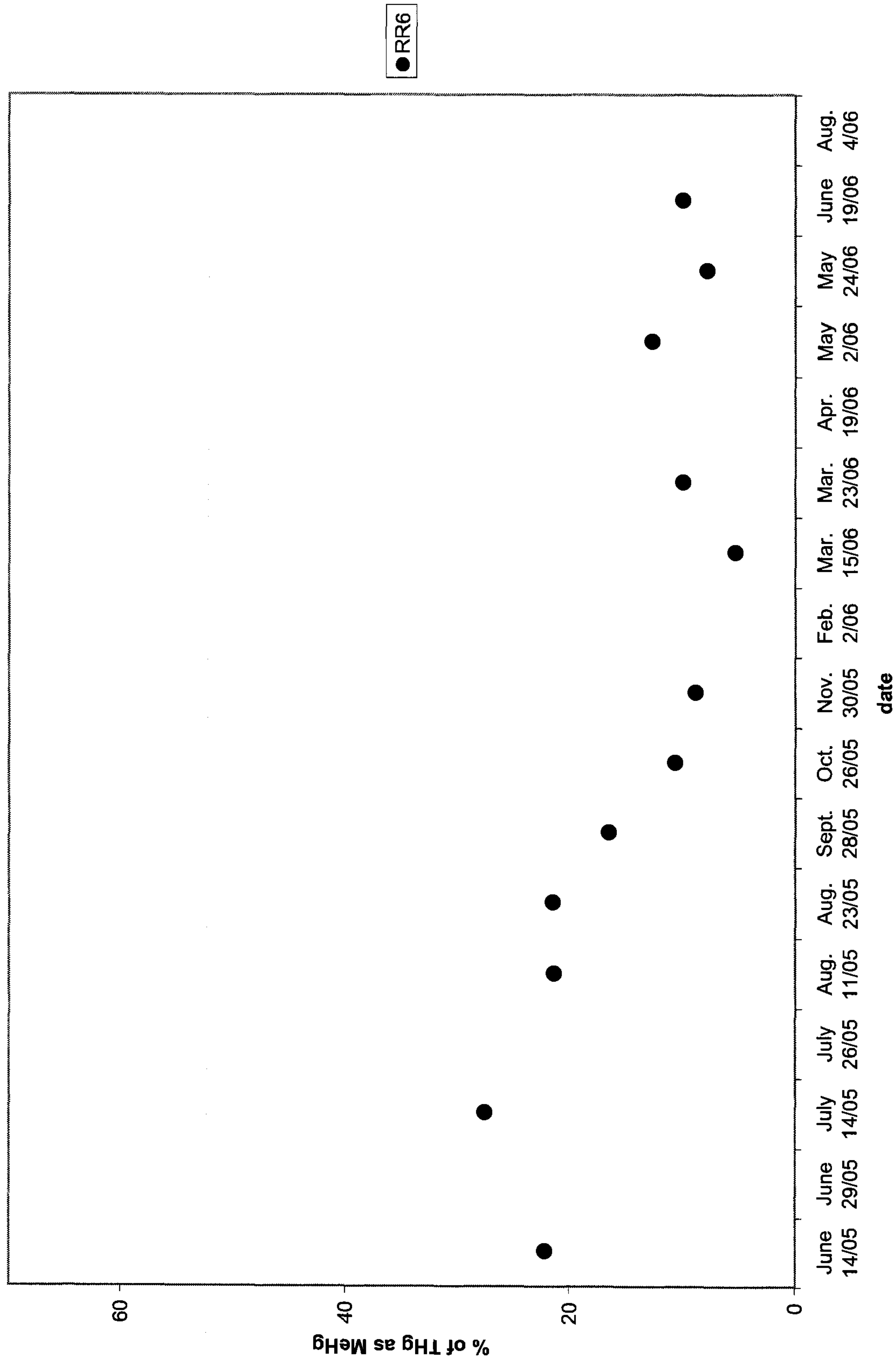

RR6
THg concentration (ng/L)
0
2
4
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 9C. Percentage of total mercury as methyl mercury for the Composite Division from June 2005 to August 2006.



RR6
% of THg as MeHg
0
20
40
60
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 10A. Methyl mercury concentrations for the South Division from June 2005 to August 2006.

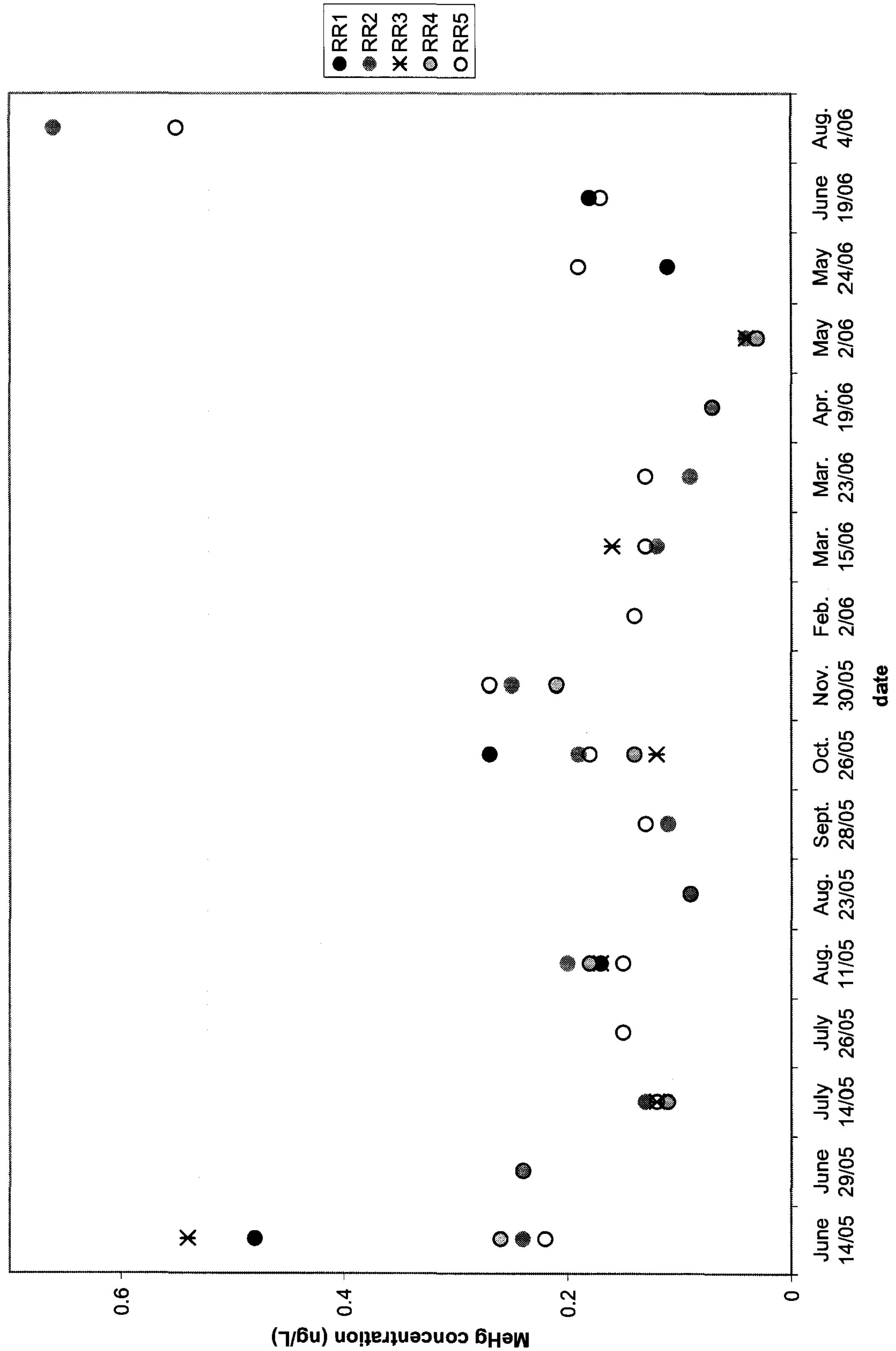

RR1
RR2
RR3
RR4
RR5
MeHg concentration (ng/L)
0
0.2
0.4
0.6
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 10B. Total mercury concentrations for the South Division from June 2005 to August 2006.

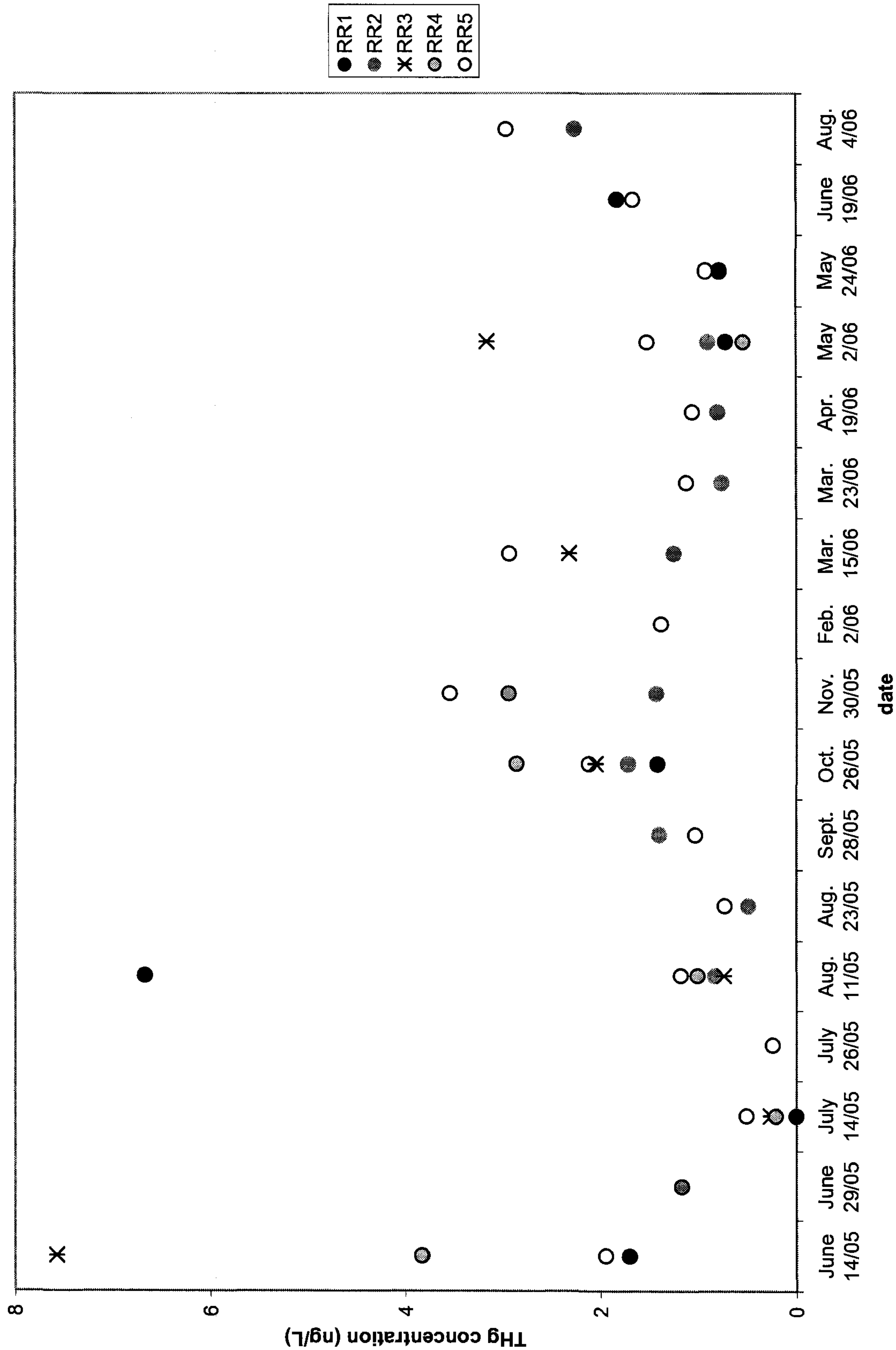

RR1
RR2
RR3
RR4
RR5
THg concentration (ng/L)
0
2
4
6
8
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 10C. Percentage of total mercury as methyl mercury for the South Division from June 2005 to August 2006.

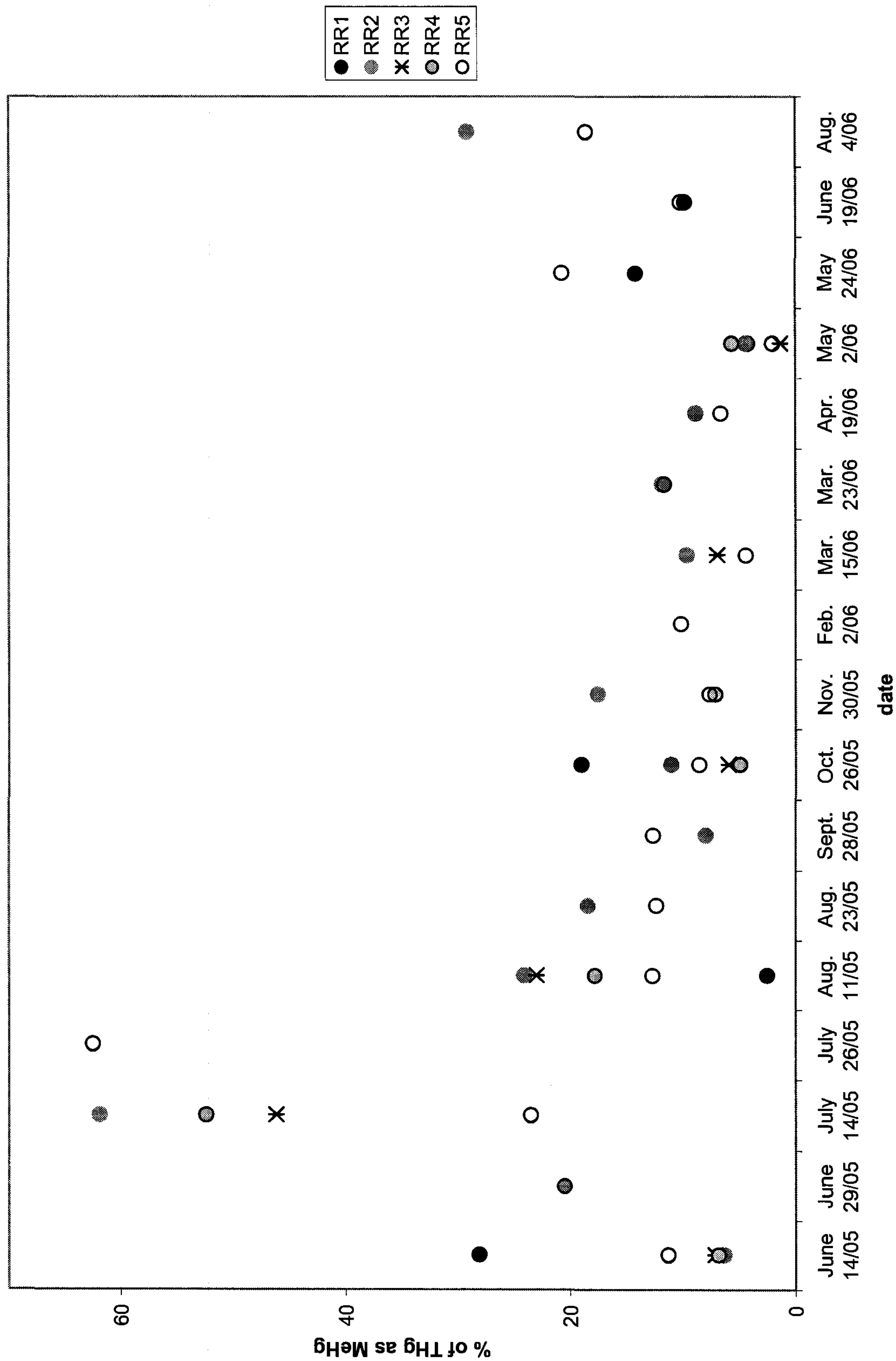

% of THg as MeHg
0
20
40
60
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date
RR1
RR2
RR3
RR4
RR5

Figure 11A. Nitrate concentrations for the North Division from June 2005 to August 2006.

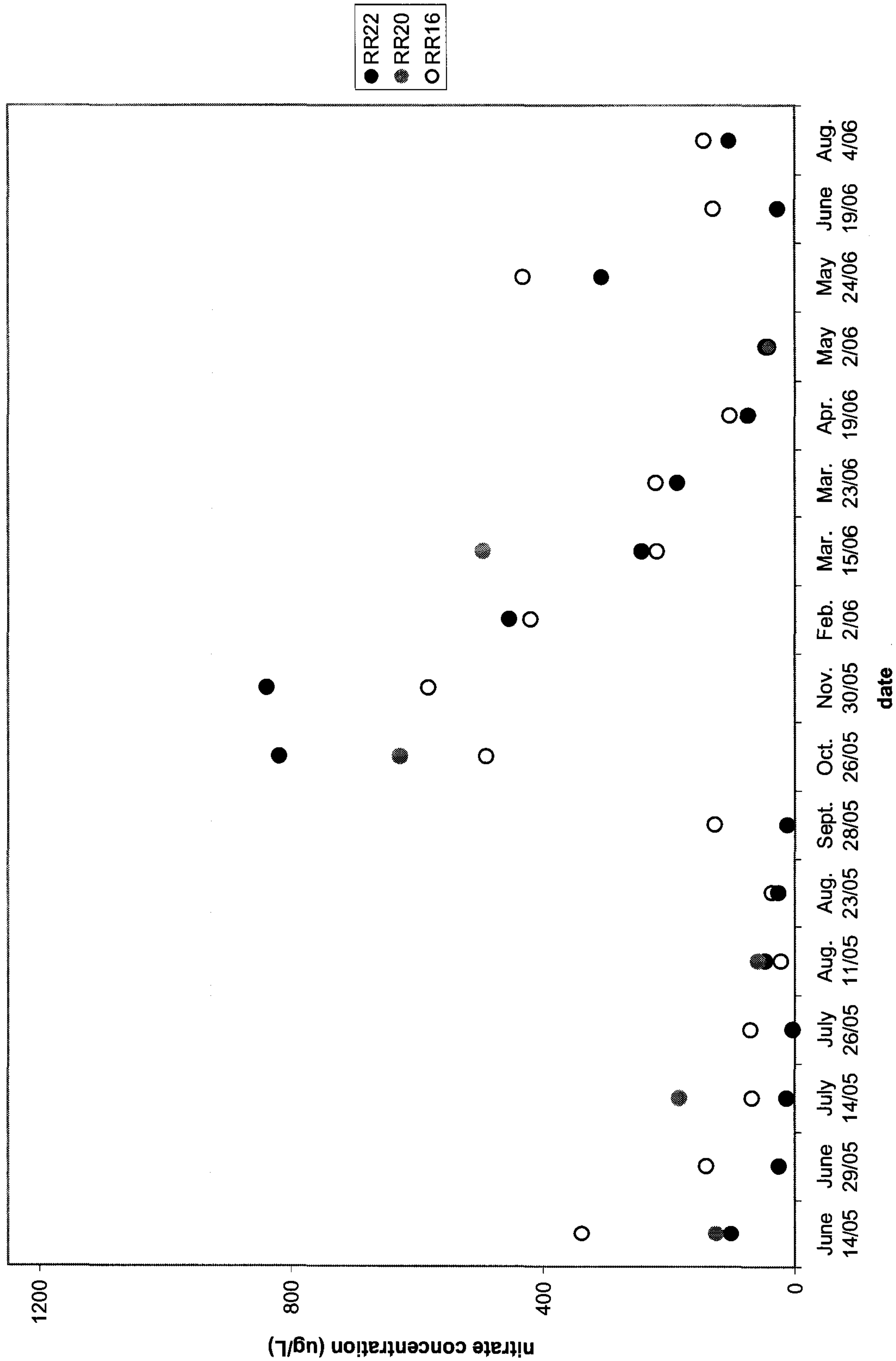

RR22
RR20
RR16
nitrate concentration (ug/L)
0
400
800
1200
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 11B. Nitrate concentrations for the Main Division from June 2005 to August 2006.

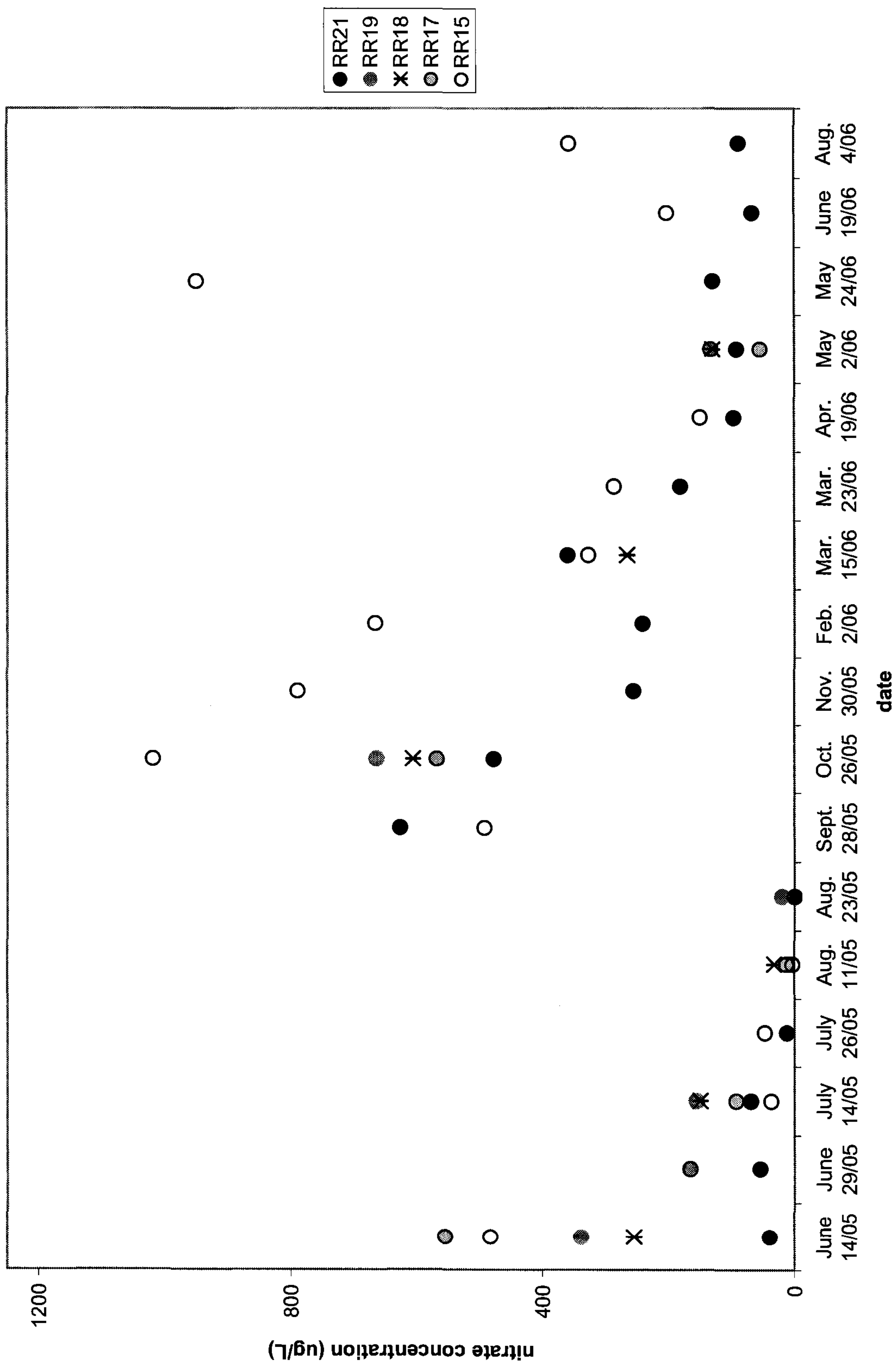

RR21
RR19
RR18
RR17
RR15
nitrate concentration (ug/L)
0
400
800
1200
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 11C. Nitrate concentrations for the North + Main Division from June 2005 to May 2006.

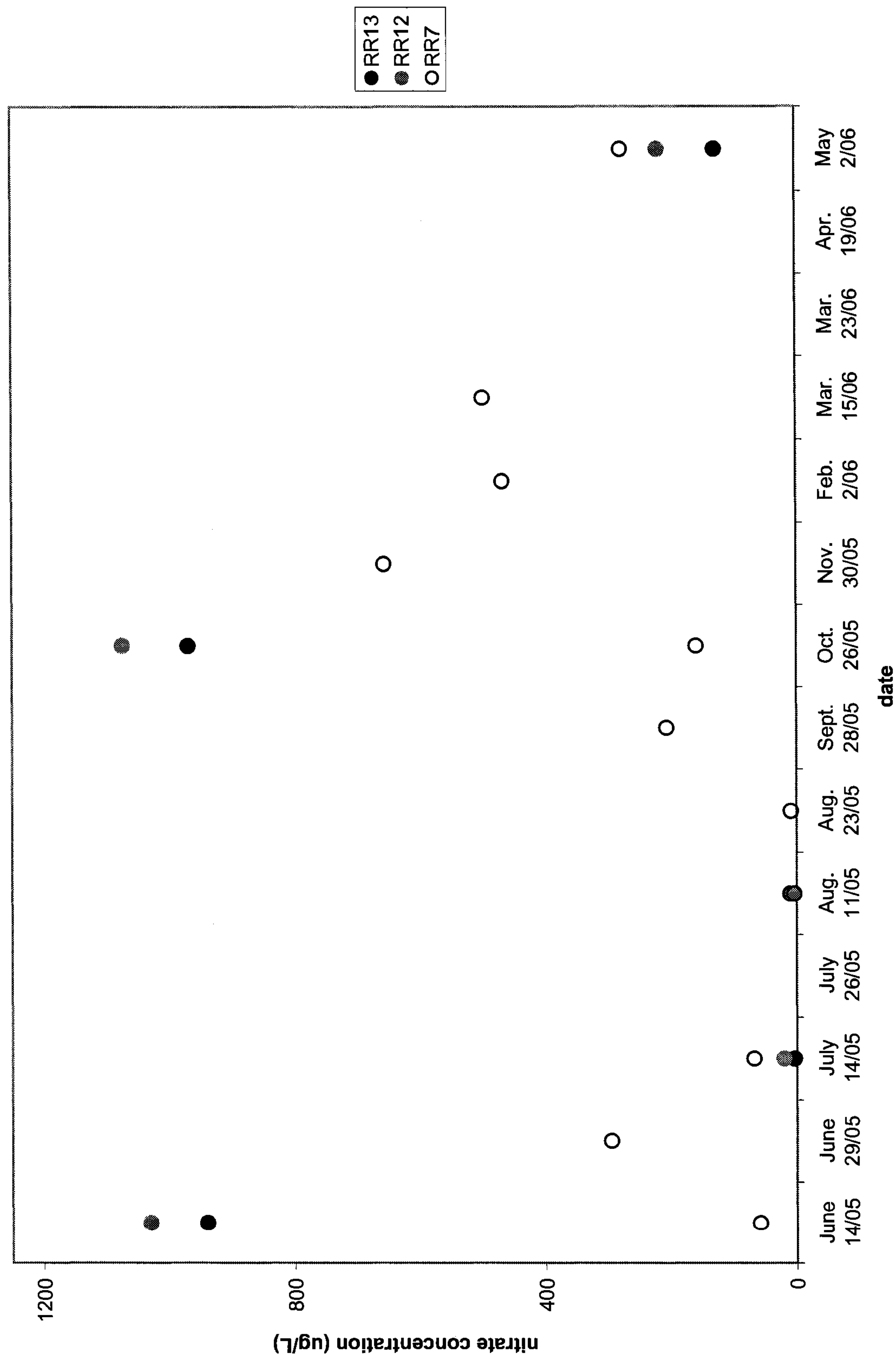

RR13
RR12
RR7
nitrate concentration (ug/L)
0
400
800
1200
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date

Figure 11D. Nitrate concentrations for the Composite Division from June 2005 to August 2006.

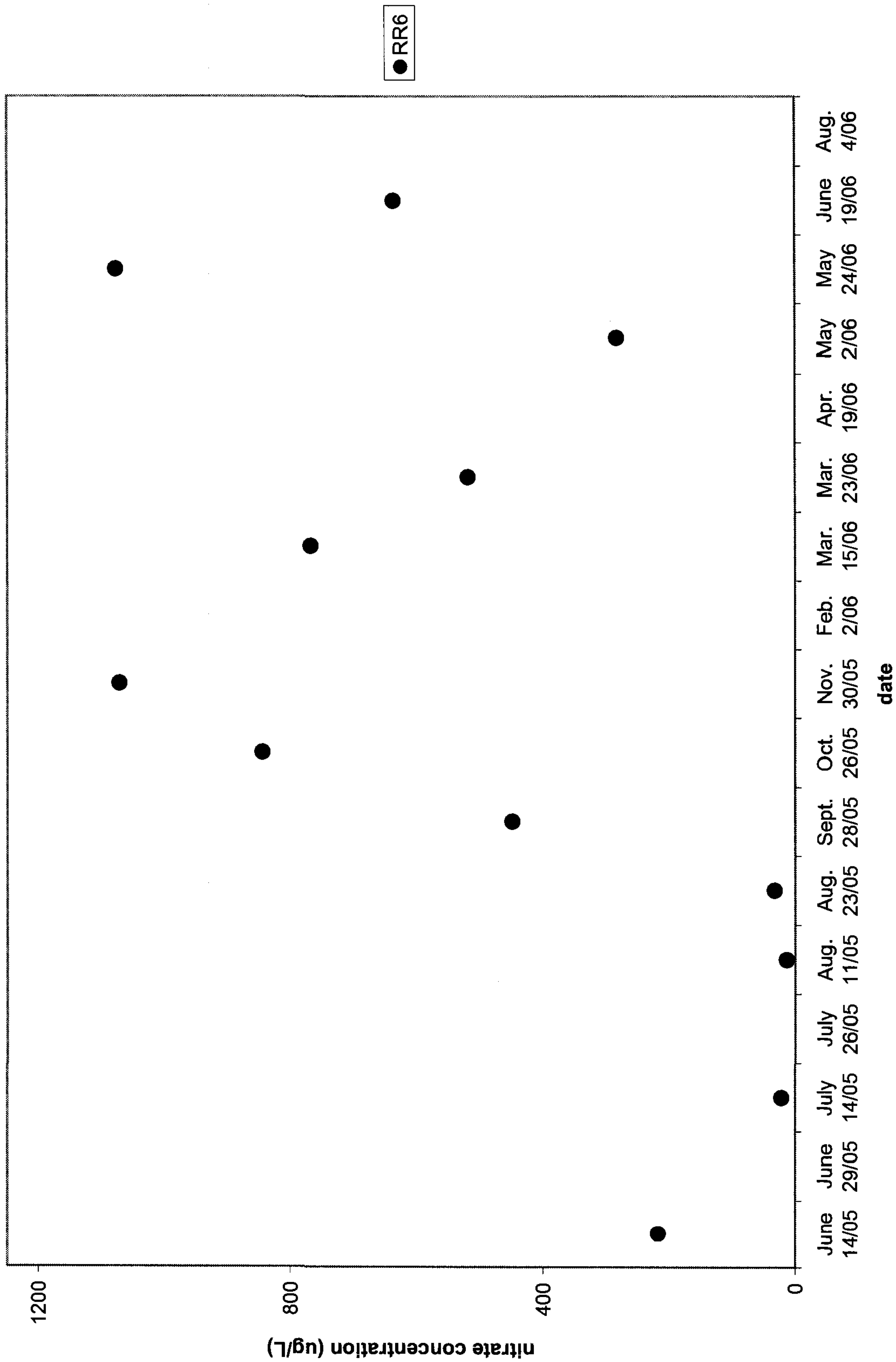

RR6
nitrate concentration (ug/L)
0
400
800
1200
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 11E. Nitrate concentrations for the South Division from June 2005 to August 2006. Data points collected from RR4 on June 14, 2005 (2575 μg L^{-1}) and RR5 on November 30, 2005 (1755 μg L^{-1}) were not included since the range was exceeded.

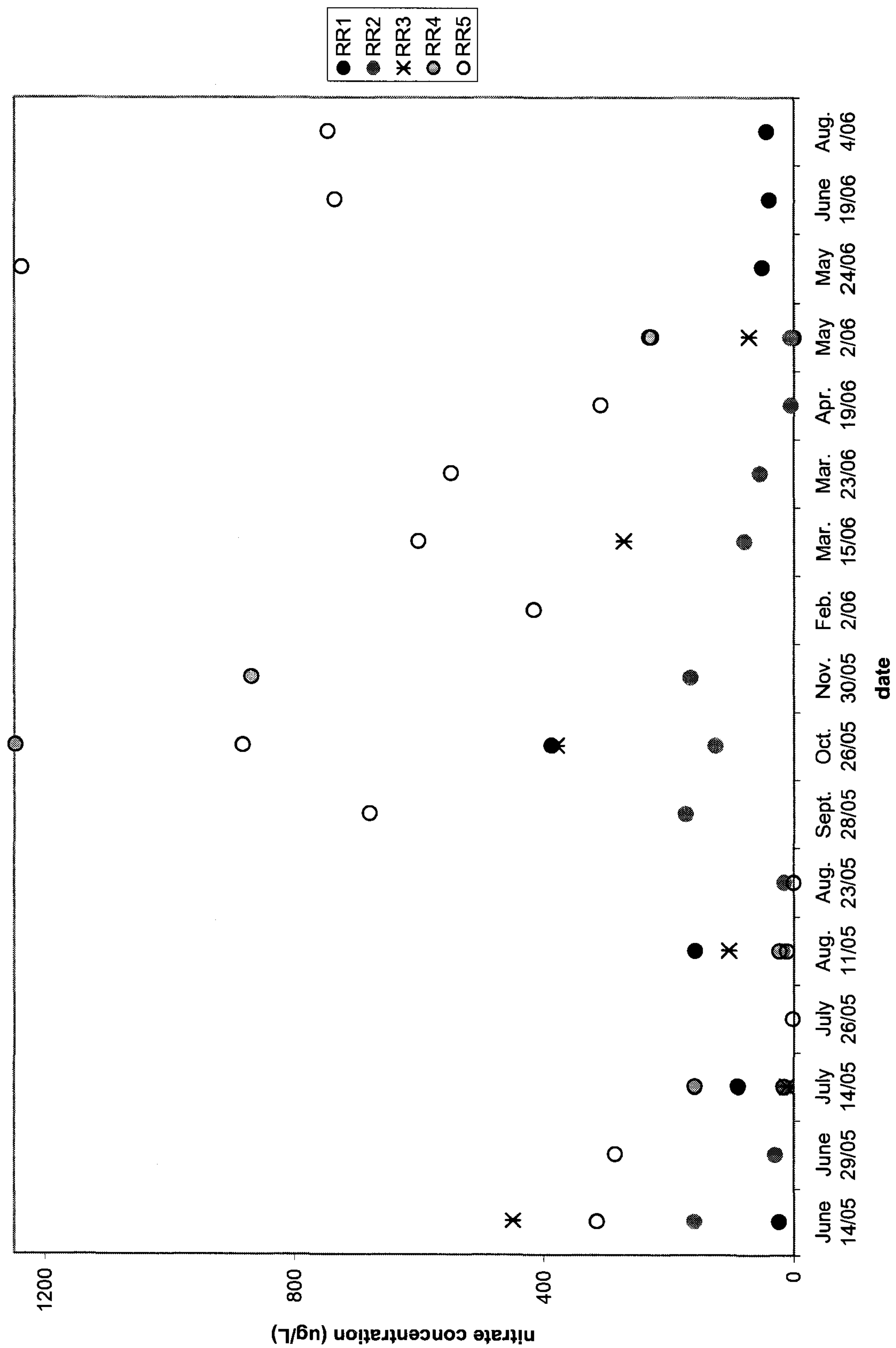

RR1
RR2
RR3
RR4
RR5
nitrate concentration (ug/L)
0
400
800
1200
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 12A. Ammonia concentrations for the North Division from June 2005 to August 2006.

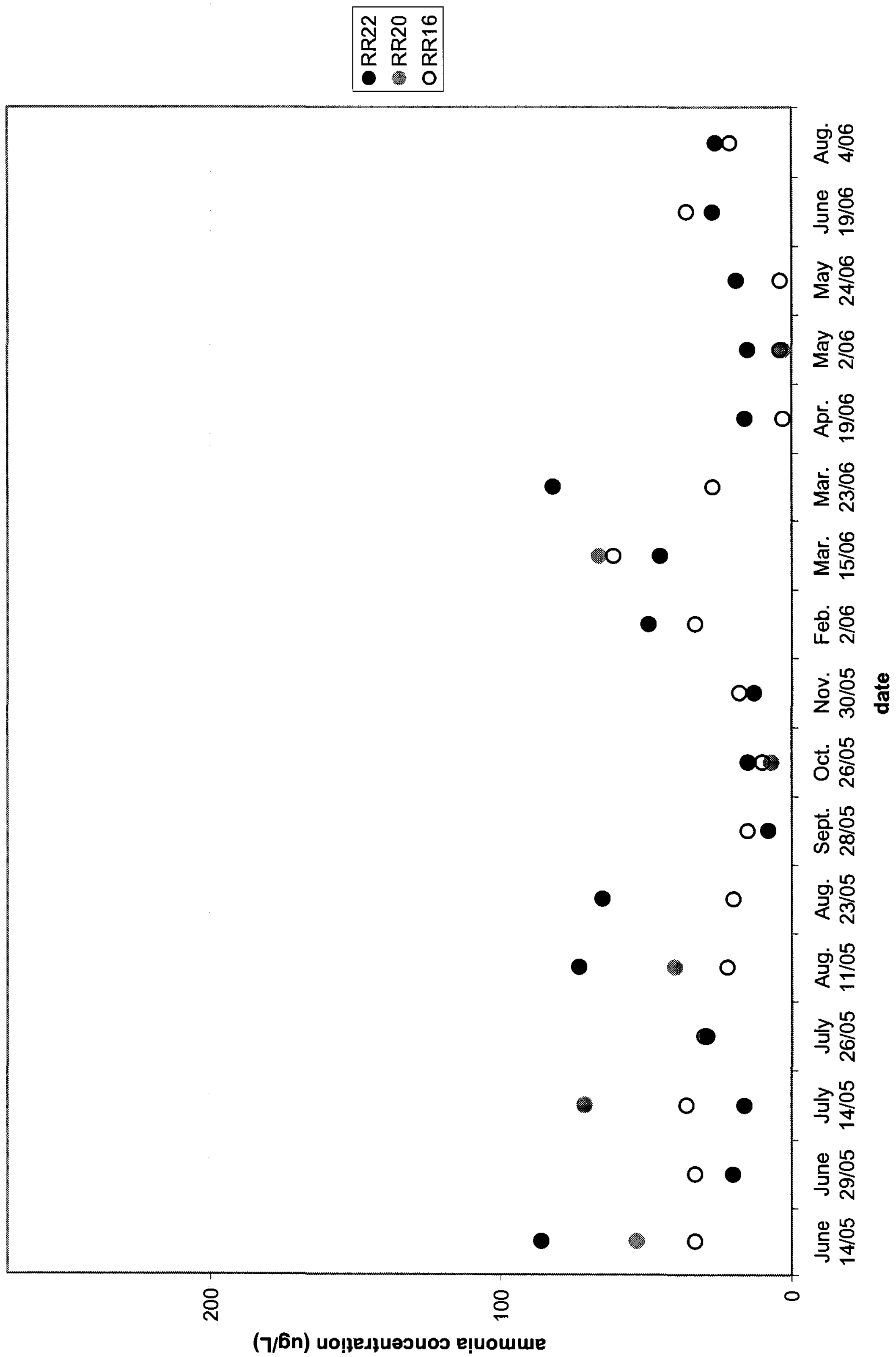

RR22
RR20
RR16
ammonia concentration (ug/L)
0
100
200
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 12B. Ammonia concentrations for the Main Division from June 2005 to August 2006.

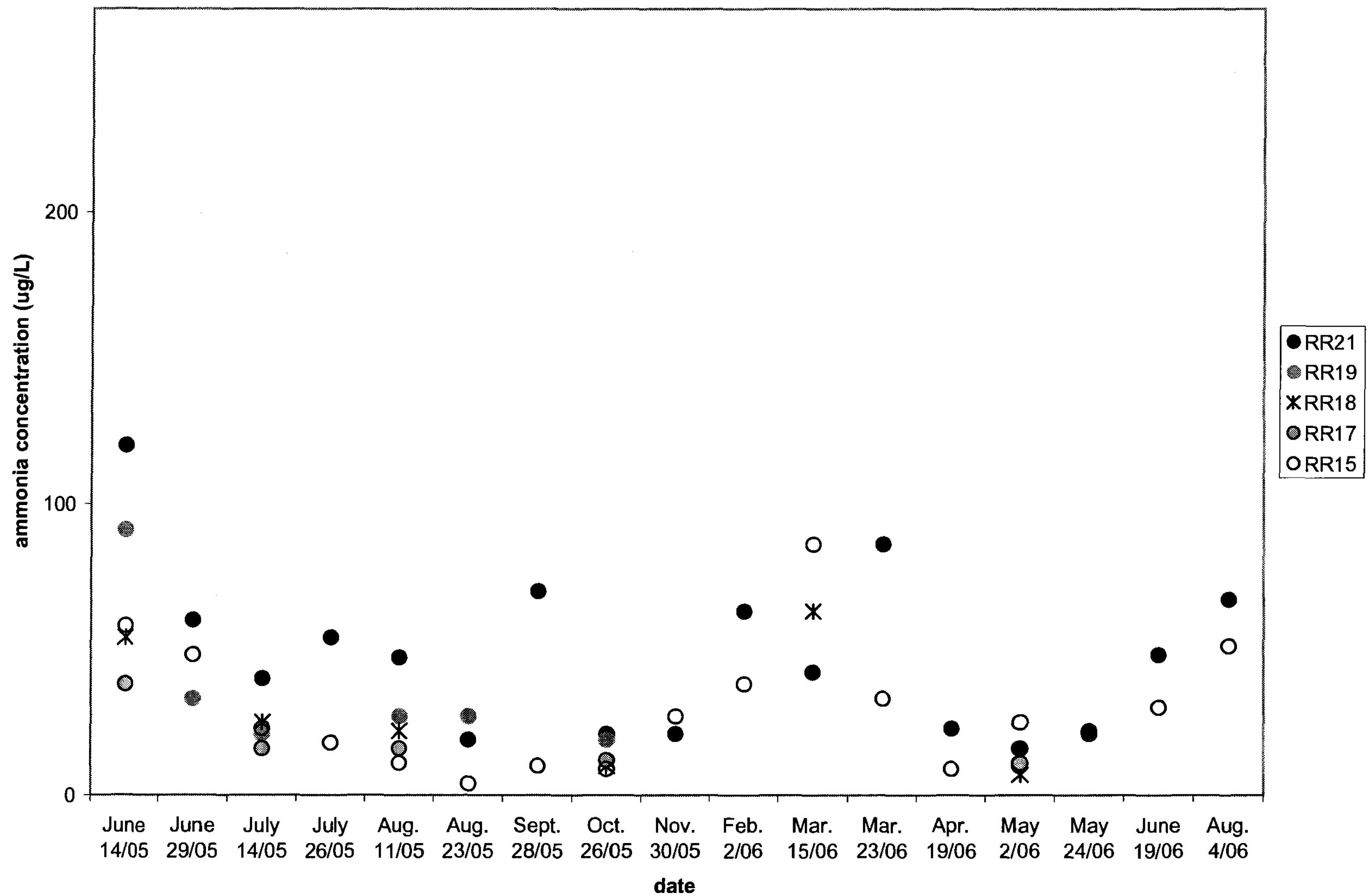

ammonia concentration (ug/L)
0
100
200
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date
RR21
RR19
RR18
RR17
RR15

Figure 12C. Ammonia concentrations for the North + Main Division from June 2005 to May 2006.

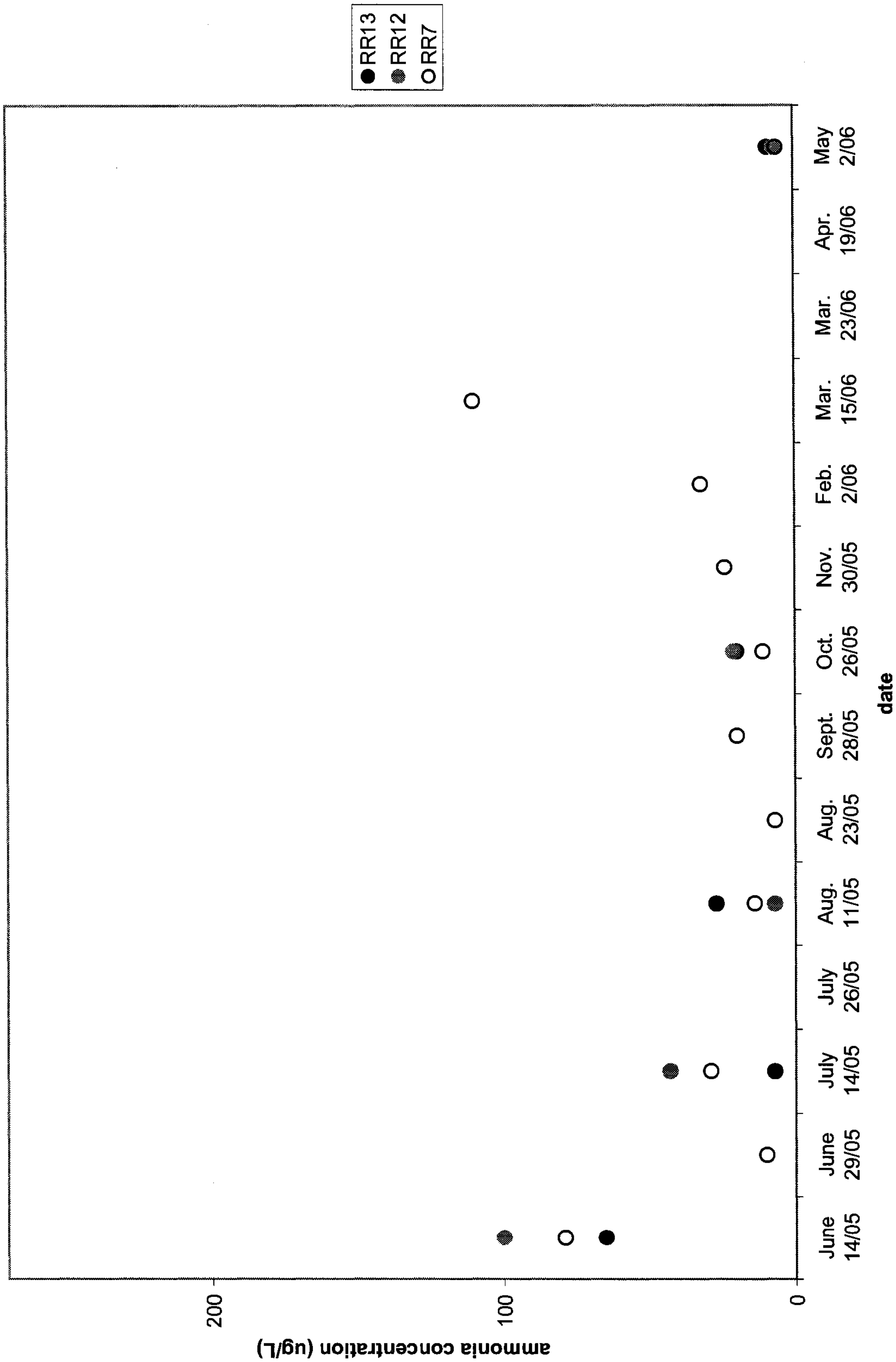
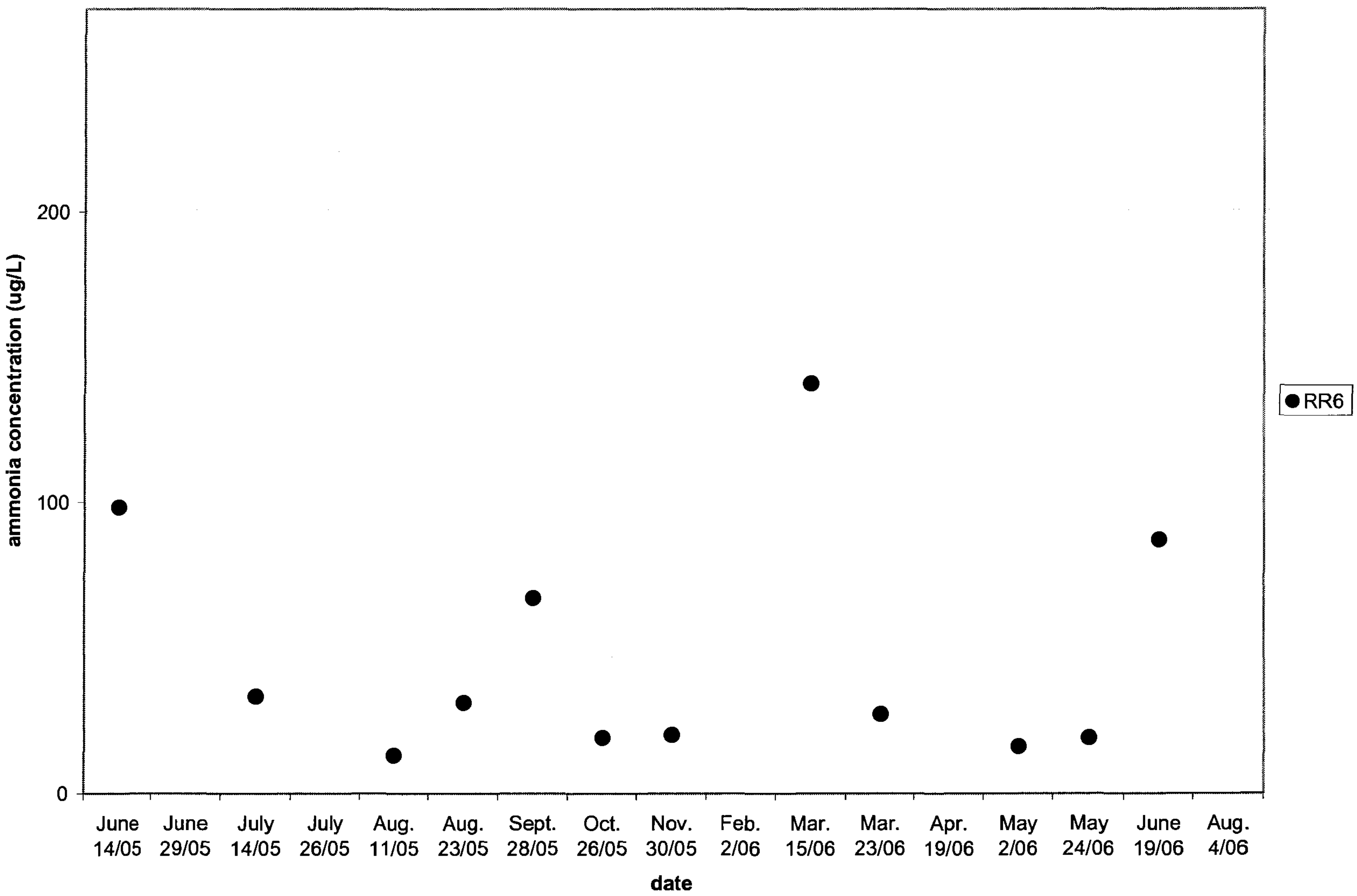
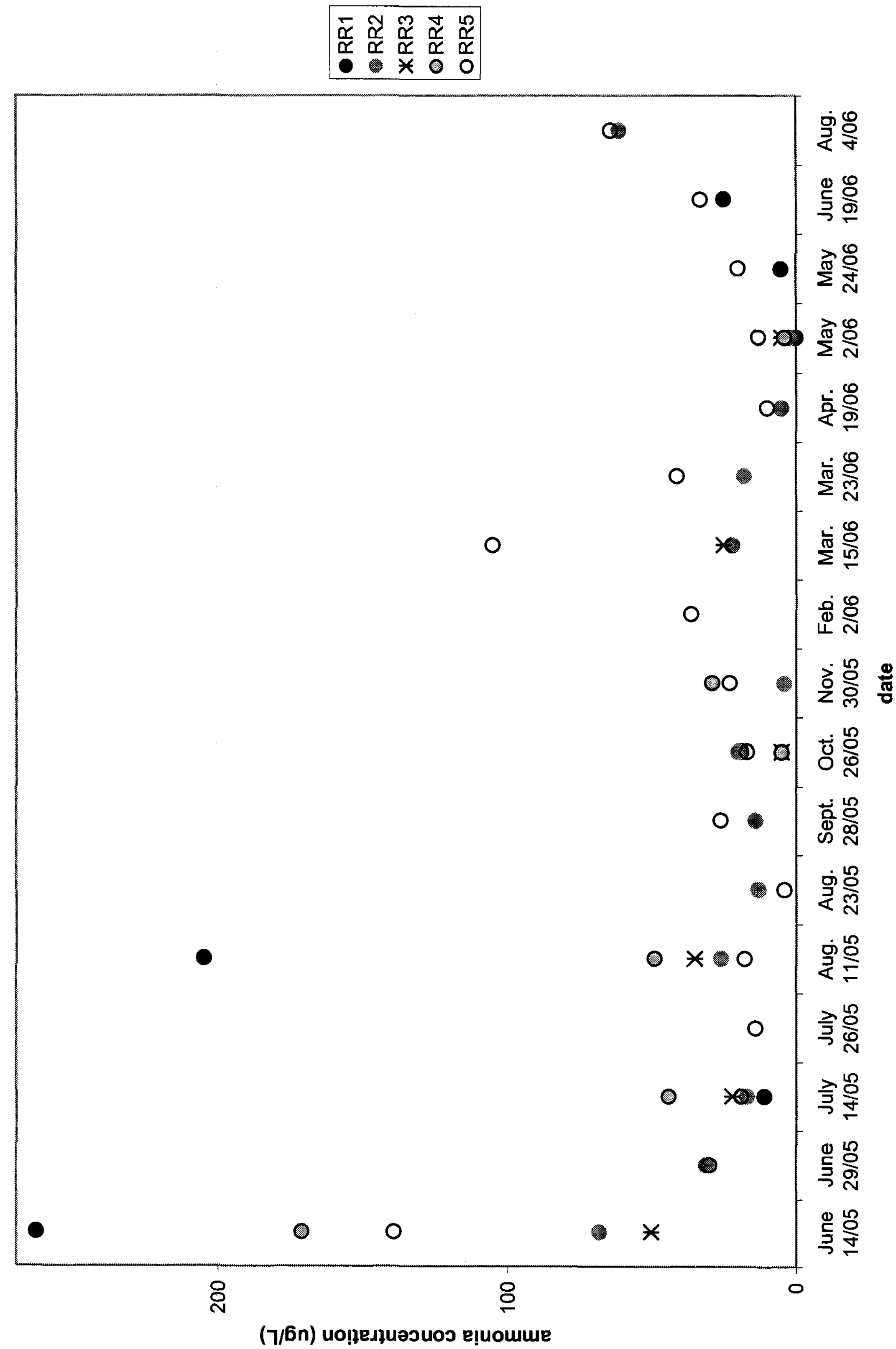

RR13
RR12
RR7
ammonia concentration (ug/L)
0
100
200
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06

Figure 12D. Ammonia concentrations for the Composite Division from June 2005 to August 2006.



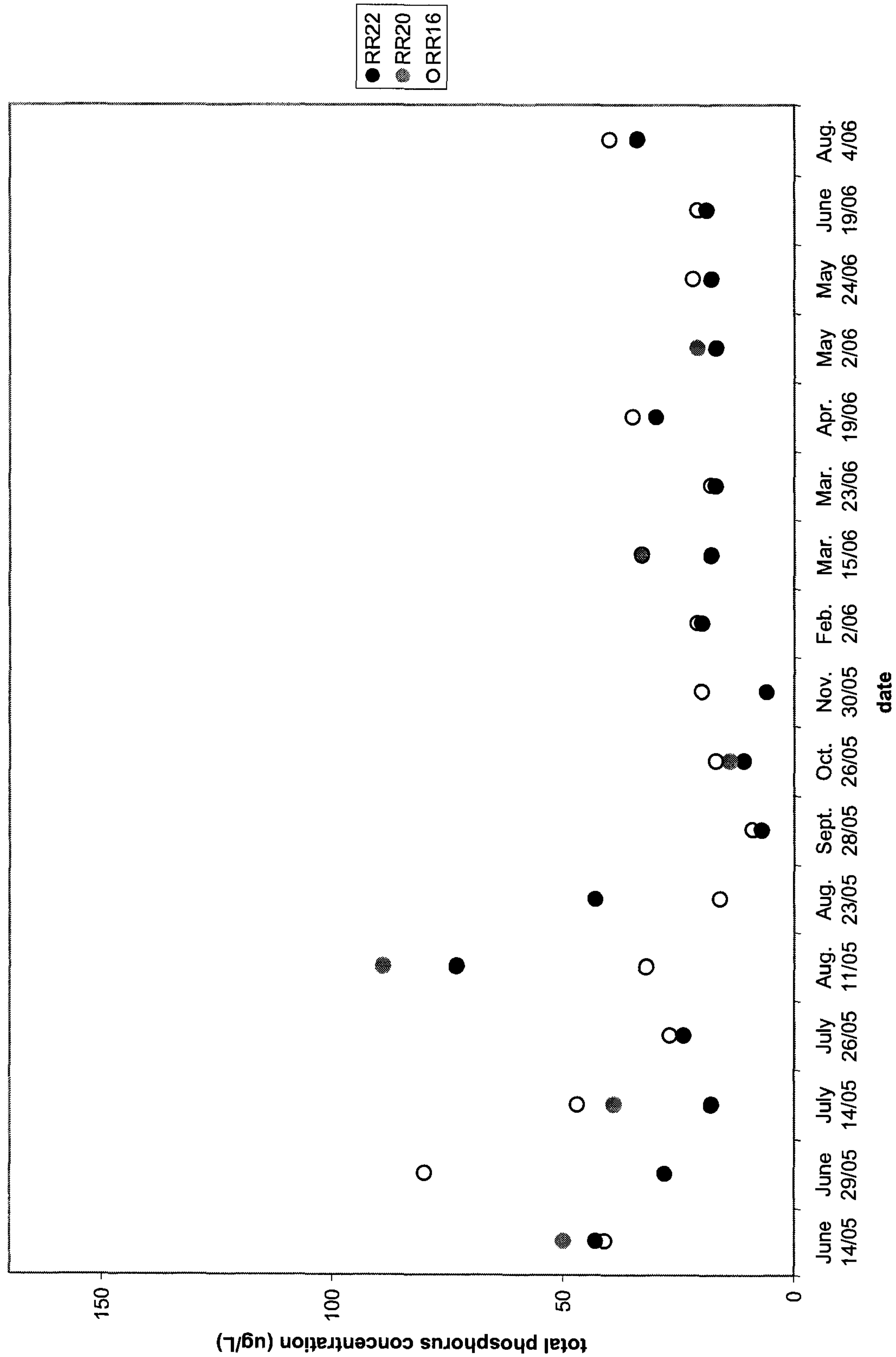
ammonia concentration (ug/L)
200
100
0
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date
RR6

Figure 12E. Ammonia concentrations for the South Division from June 2005 to August 2006.



RR1
RR2
RR3
RR4
RR5
ammonia concentration (ug/L)
0
100
200
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 13A. Total phosphorus concentrations for the North Division from June 2005 to August 2006.



total phosphorus concentration (ug/L)
0
50
100
150
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
RR22
RR20
RR16

Figure 13B. Total phosphorus concentrations for the Main Division from June 2005 to August 2006.

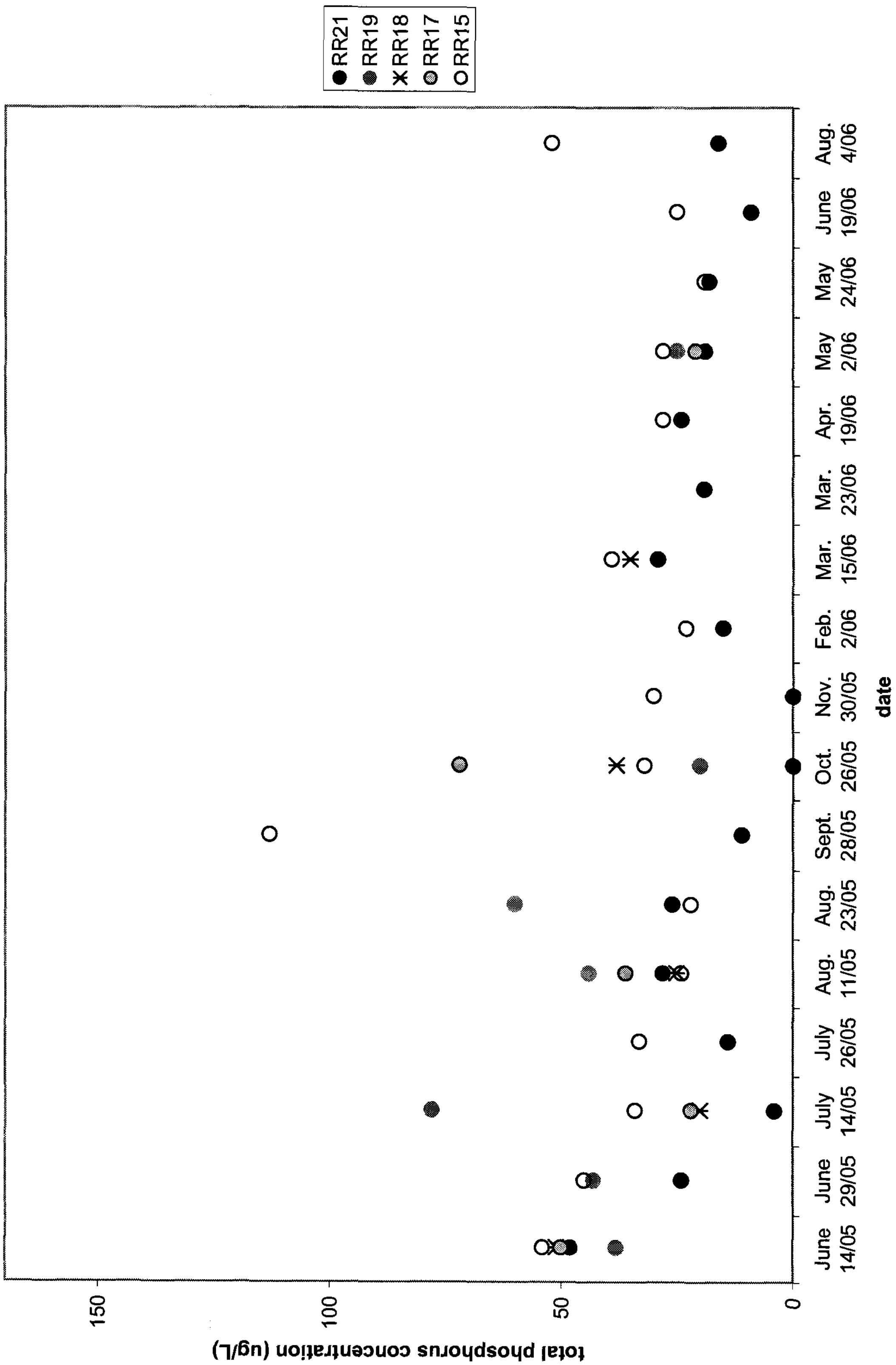
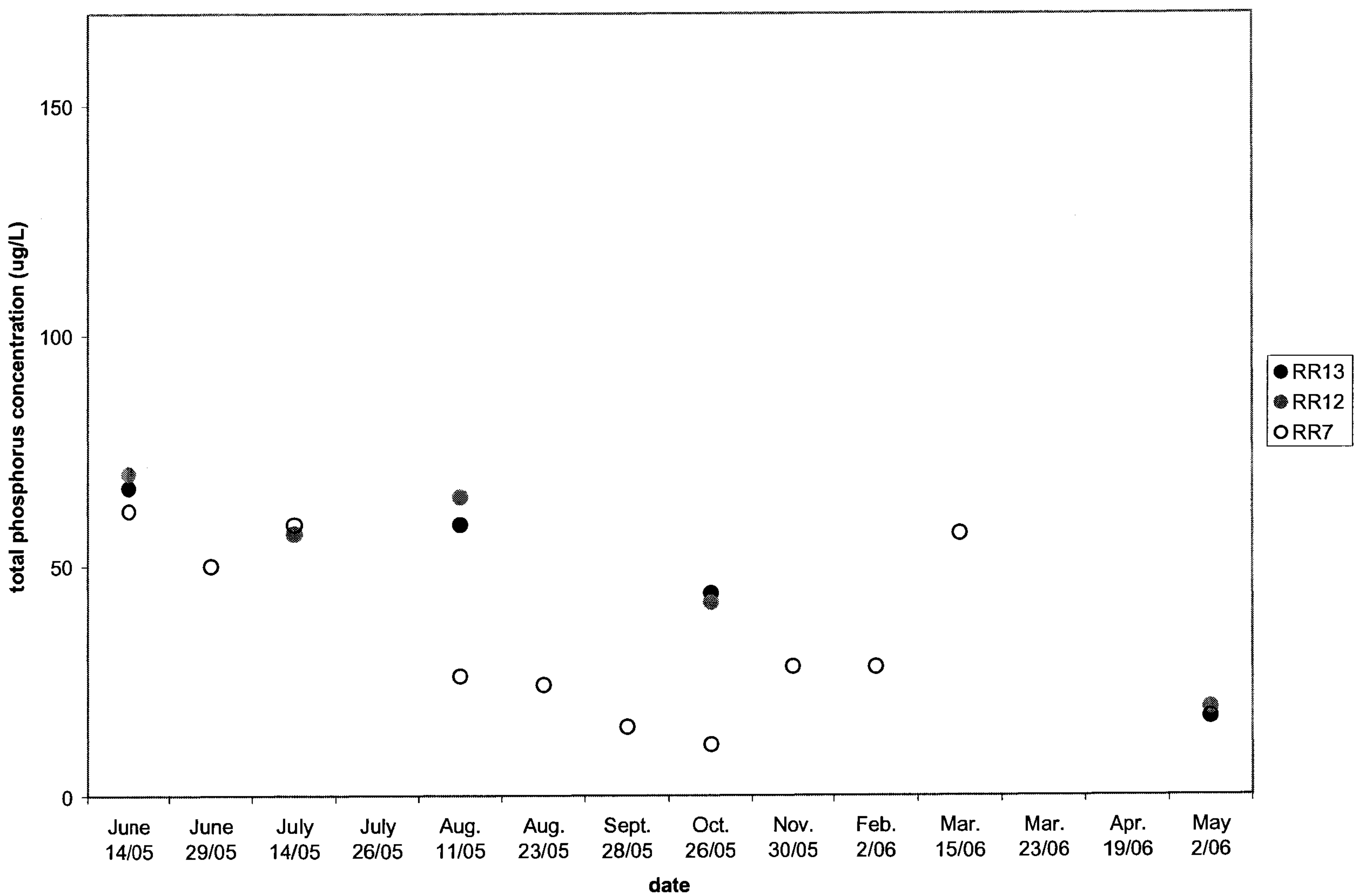

RR21
RR19
RR18
RR17
RR15
total phosphorus concentration (ug/L)
0
50
100
150
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 13C. Total phosphorus concentrations for the North + Main Division from June 2005 to May 2006.



total phosphorus concentration (ug/L)
150
100
50
0
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date
RR13
RR12
RR7

Figure 13D. Total phosphorus concentrations for the Composite Division from June 2005 to August 2006.

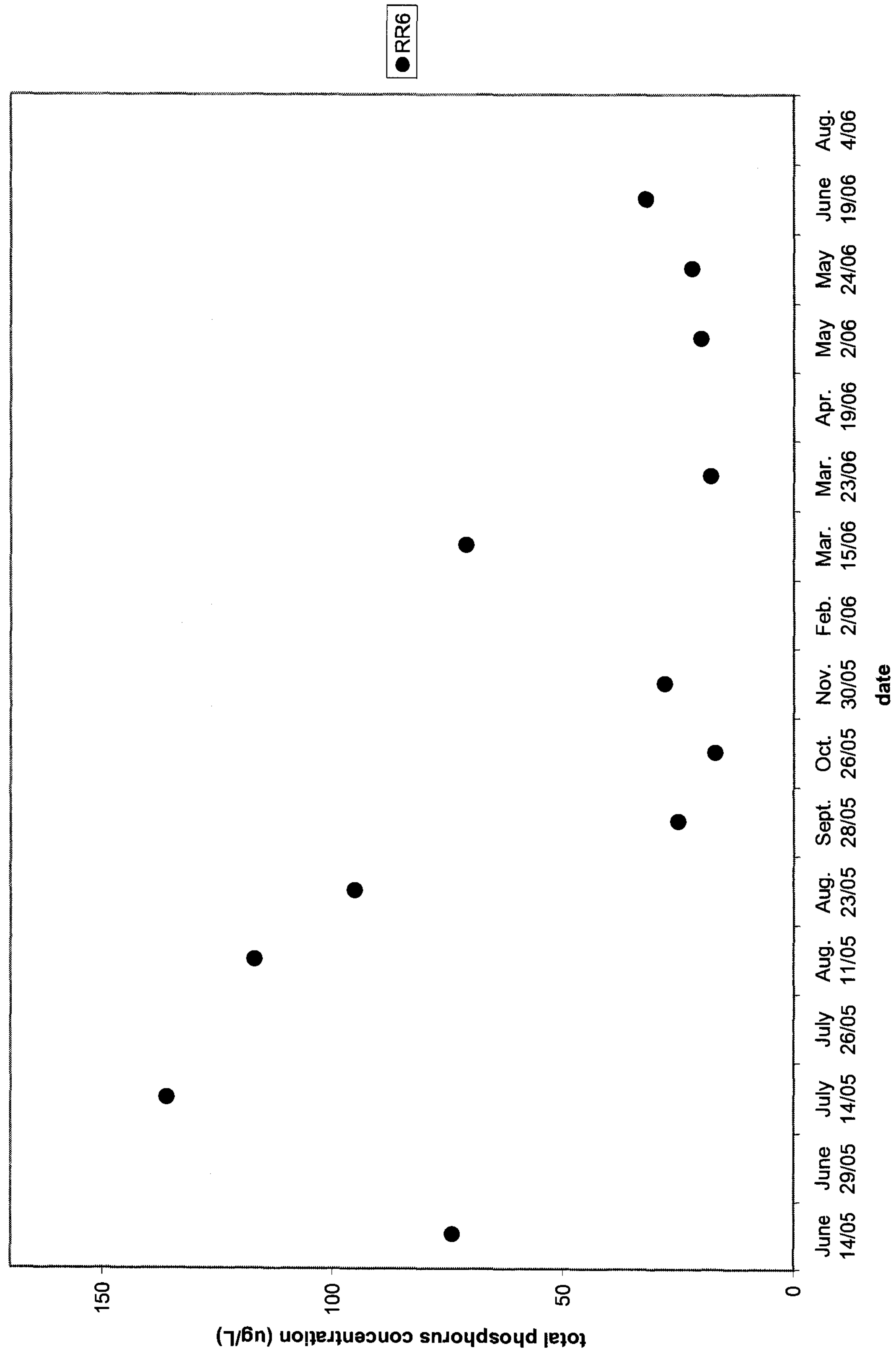

RR6
total phosphorus concentration (ug/L)
0
50
100
150
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 13E. Total phosphorus concentrations for the South Division from June 2005 to August 2006.

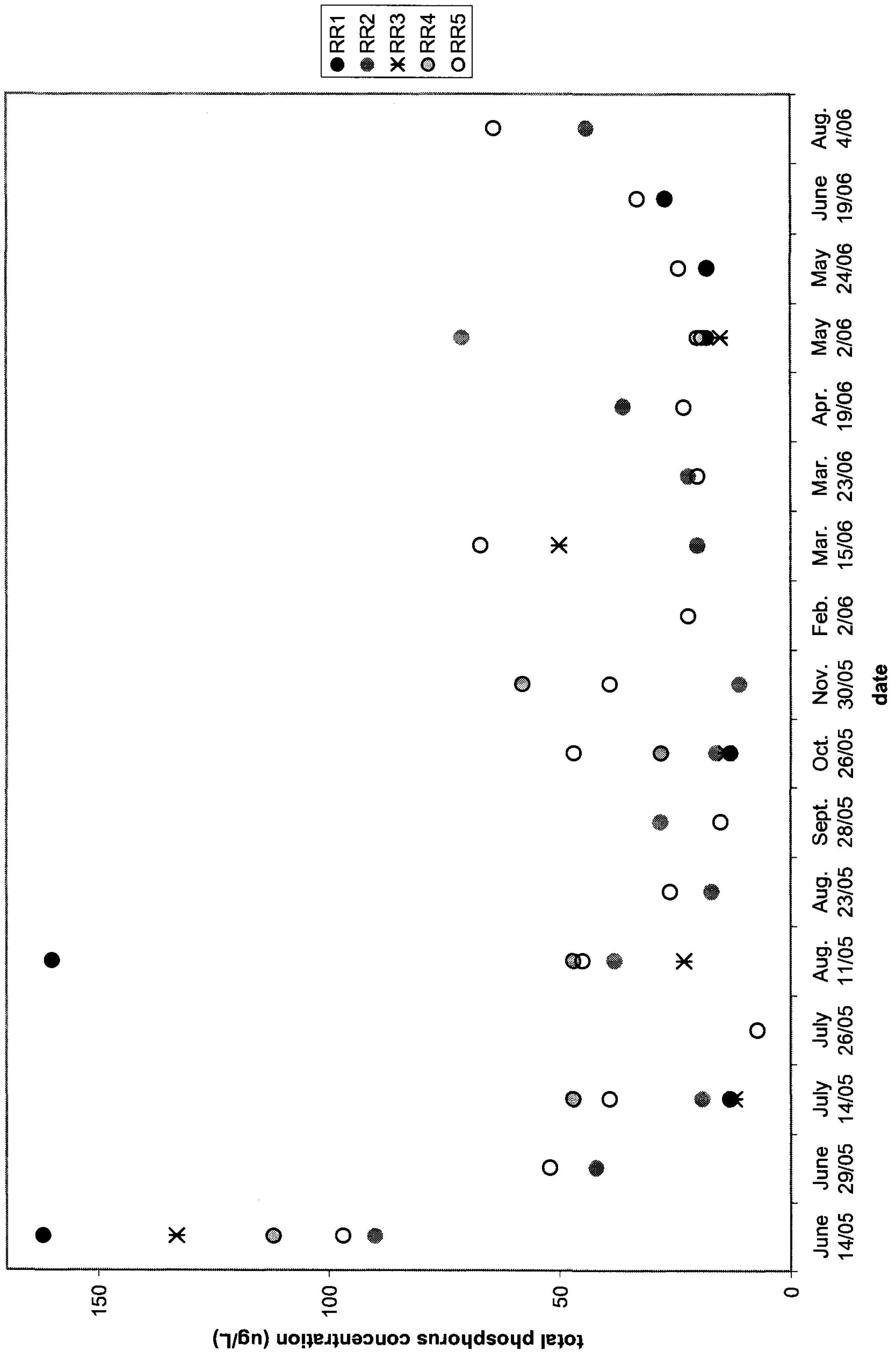

RR1
RR2
RR3
RR4
RR5
total phosphorus concentration (ug/L)
0
50
100
150
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 14A. Sulphate concentrations for the North Division from June 2005 to August 2006.

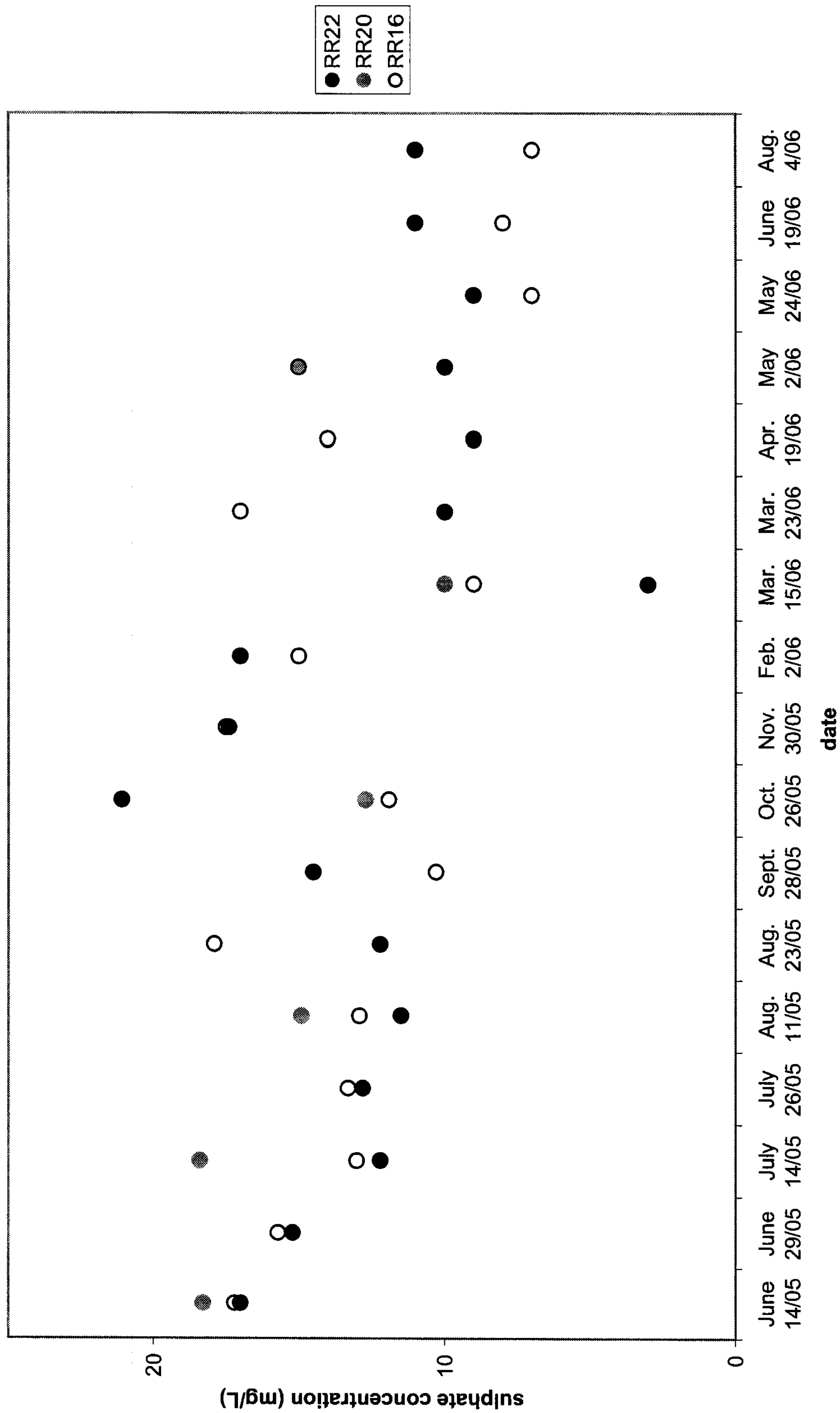

RR22
RR20
RR16
sulphate concentration (mg/L)
20
10
0
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 14B. Sulphate concentrations for the Main Division from June 2005 to 2006.

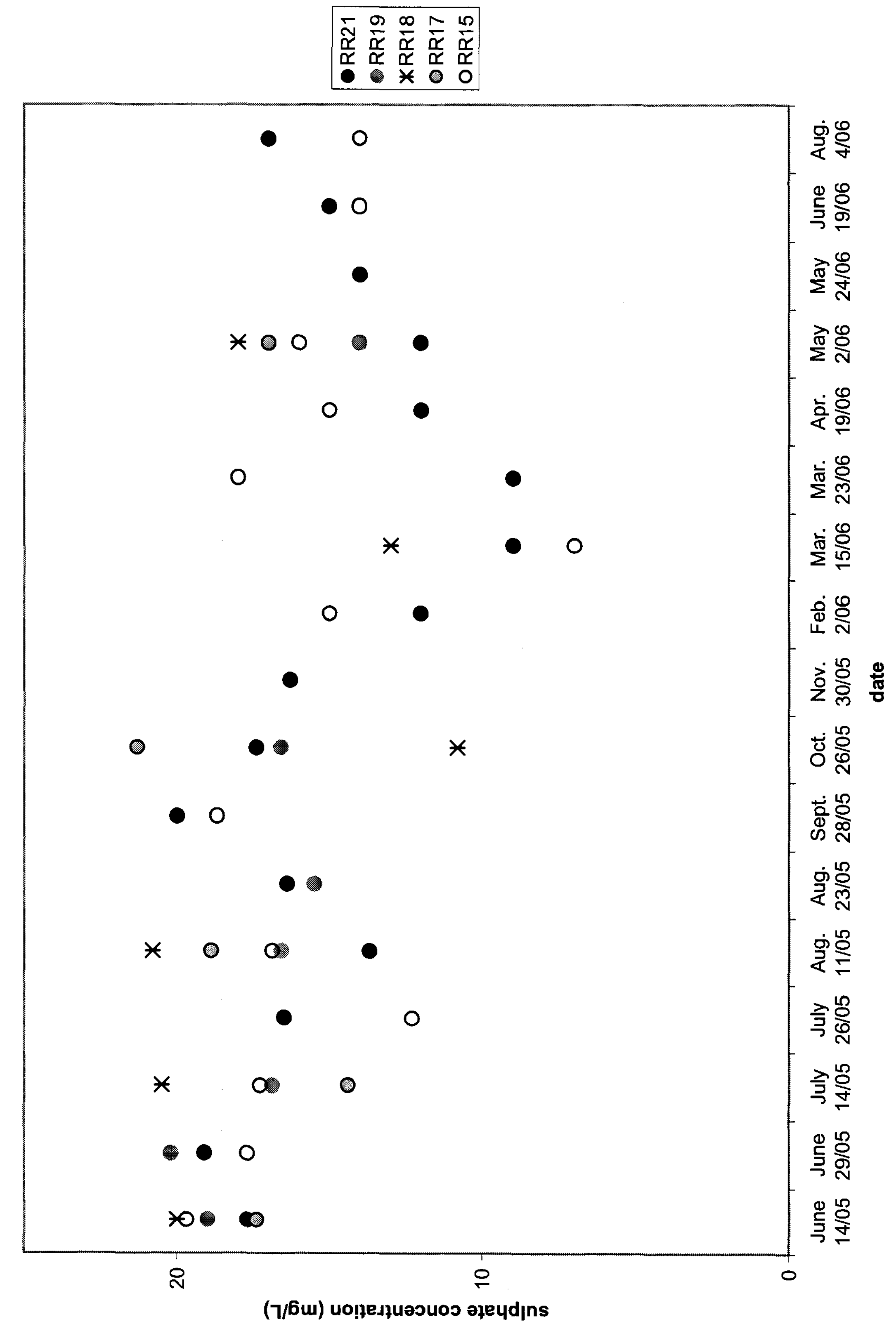

RR21
RR19
RR18
RR17
RR15
sulphate concentration (mg/L)
0
10
20
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 14C. Sulphate concentrations for the North + Main Division from June 2005 to May 2006.

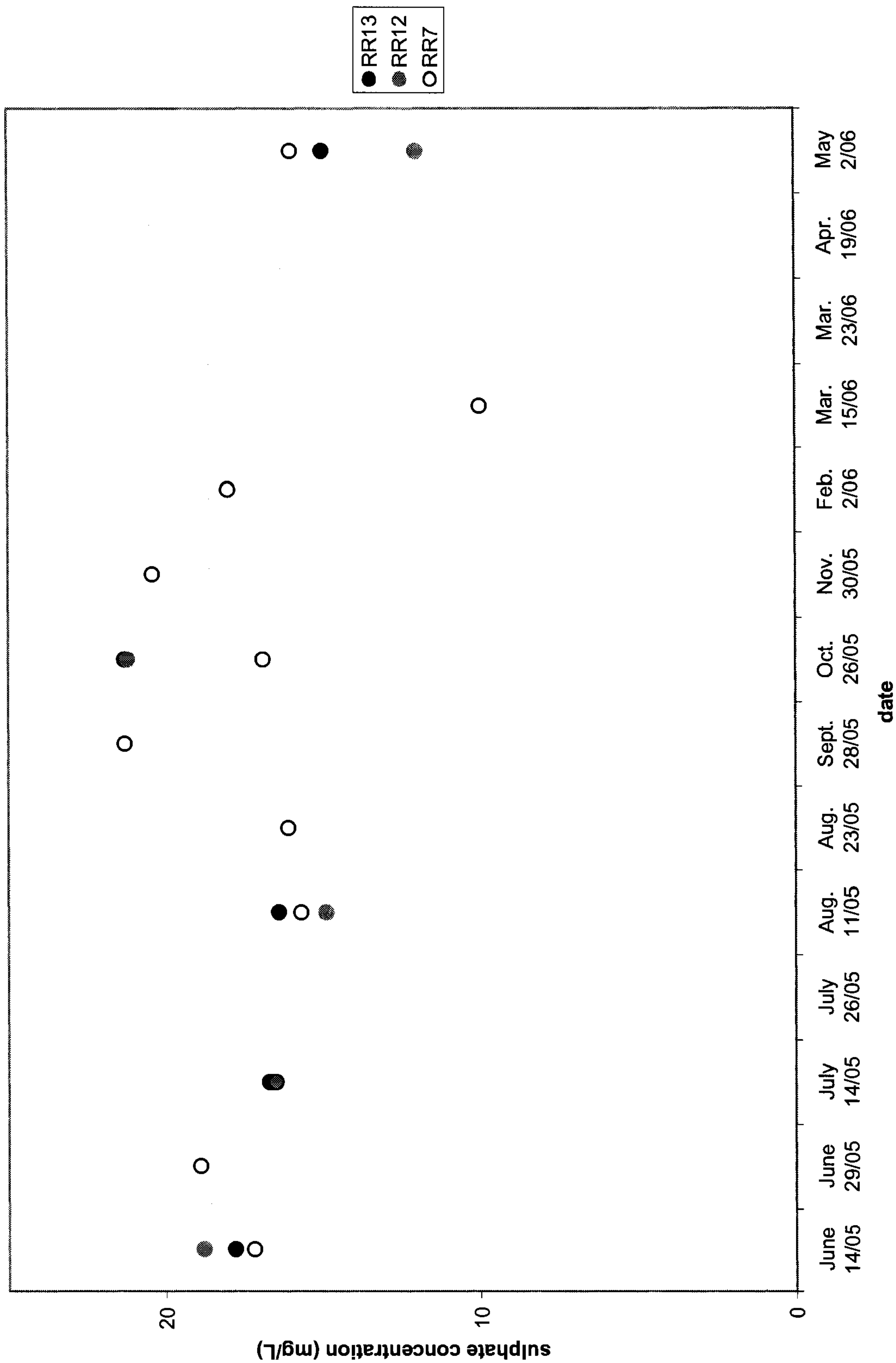

RR13
RR12
RR7
20
10
0
sulphate concentration (mg/L)
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date

Figure 14D. Sulphate concentrations for the Composite Division from June 2005 to August 2006.

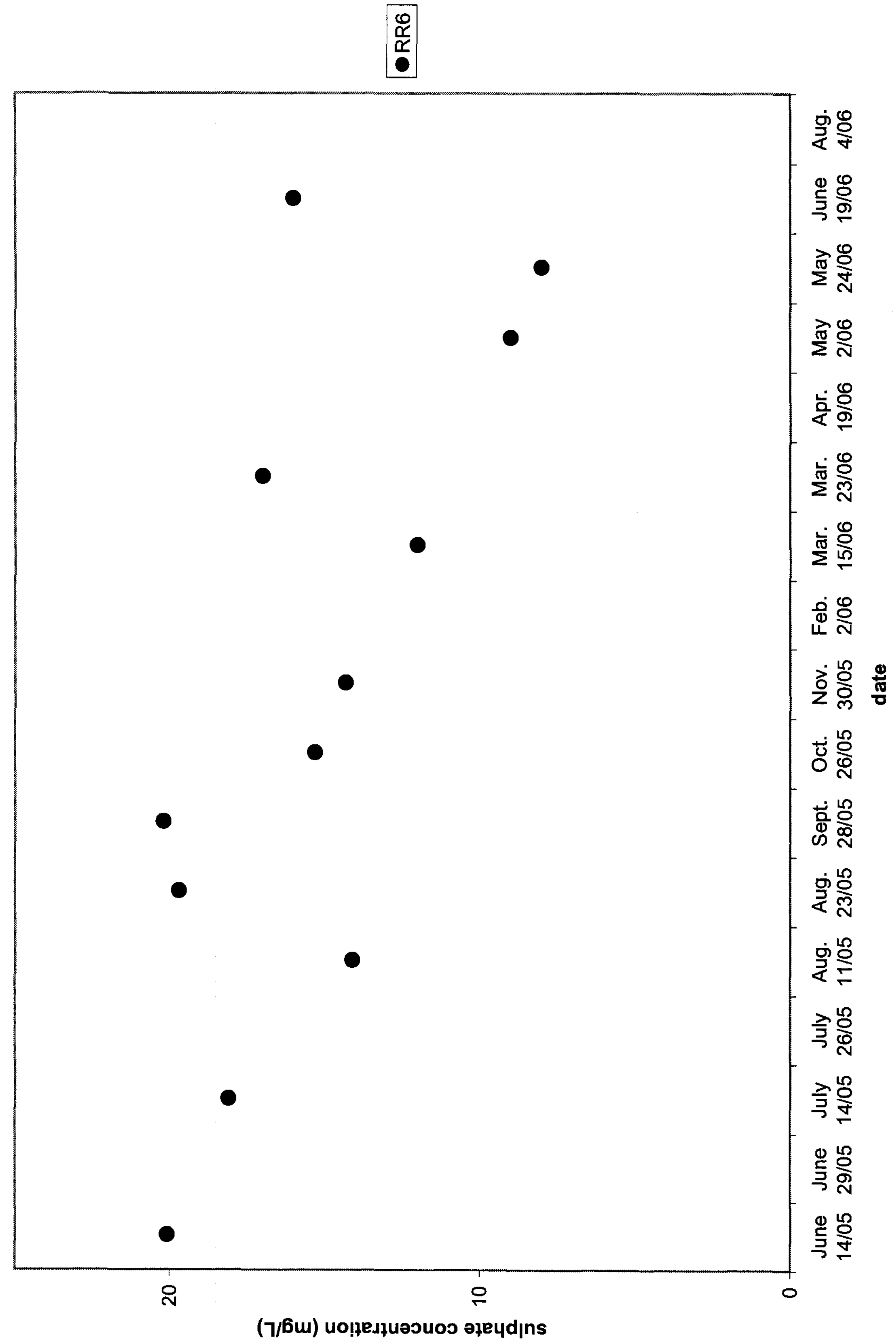

RR6
sulphate concentration (mg/L)
0
10
20
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 14E. Sulphate concentrations for the South Division from June 2005 to August 2006.

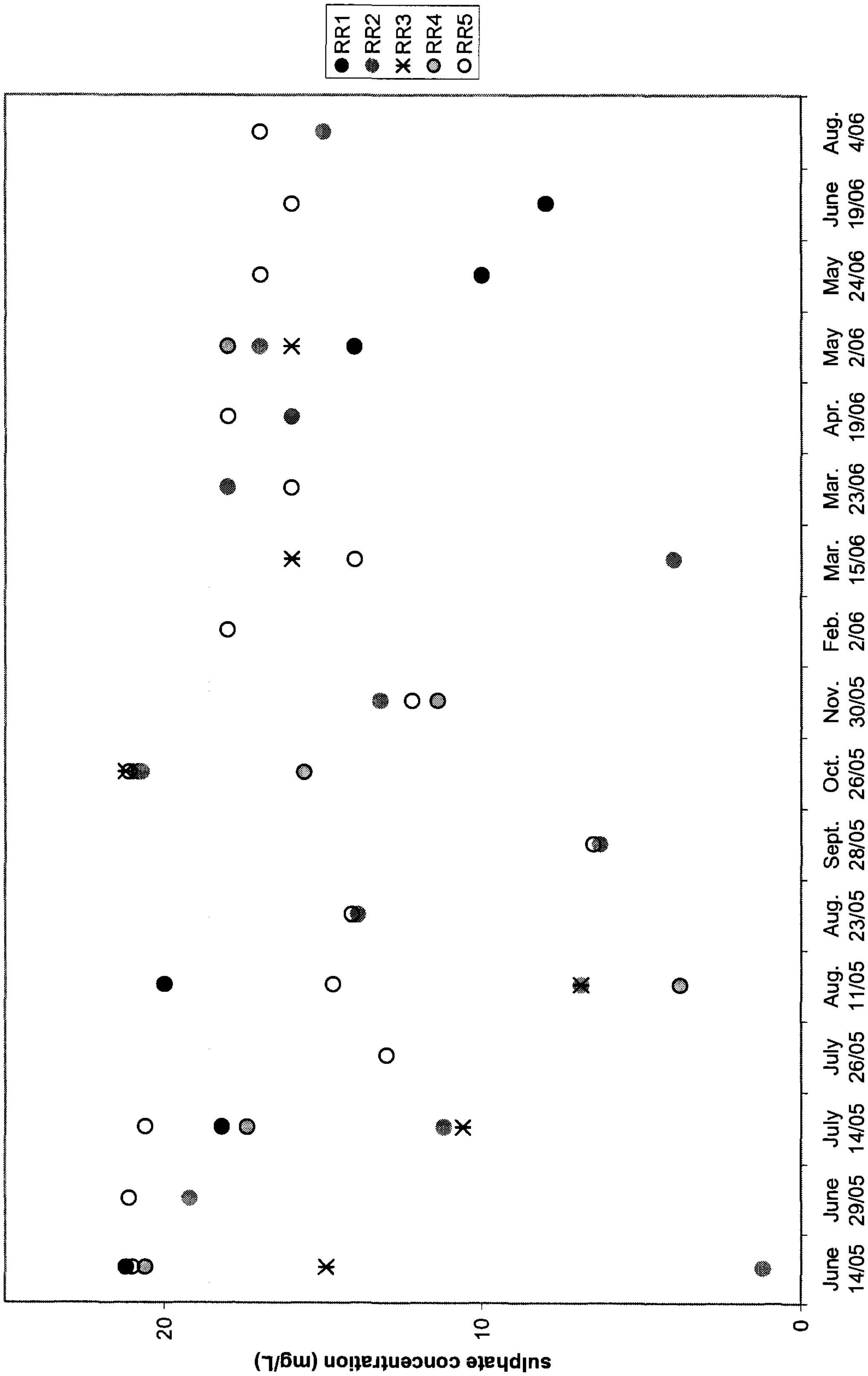
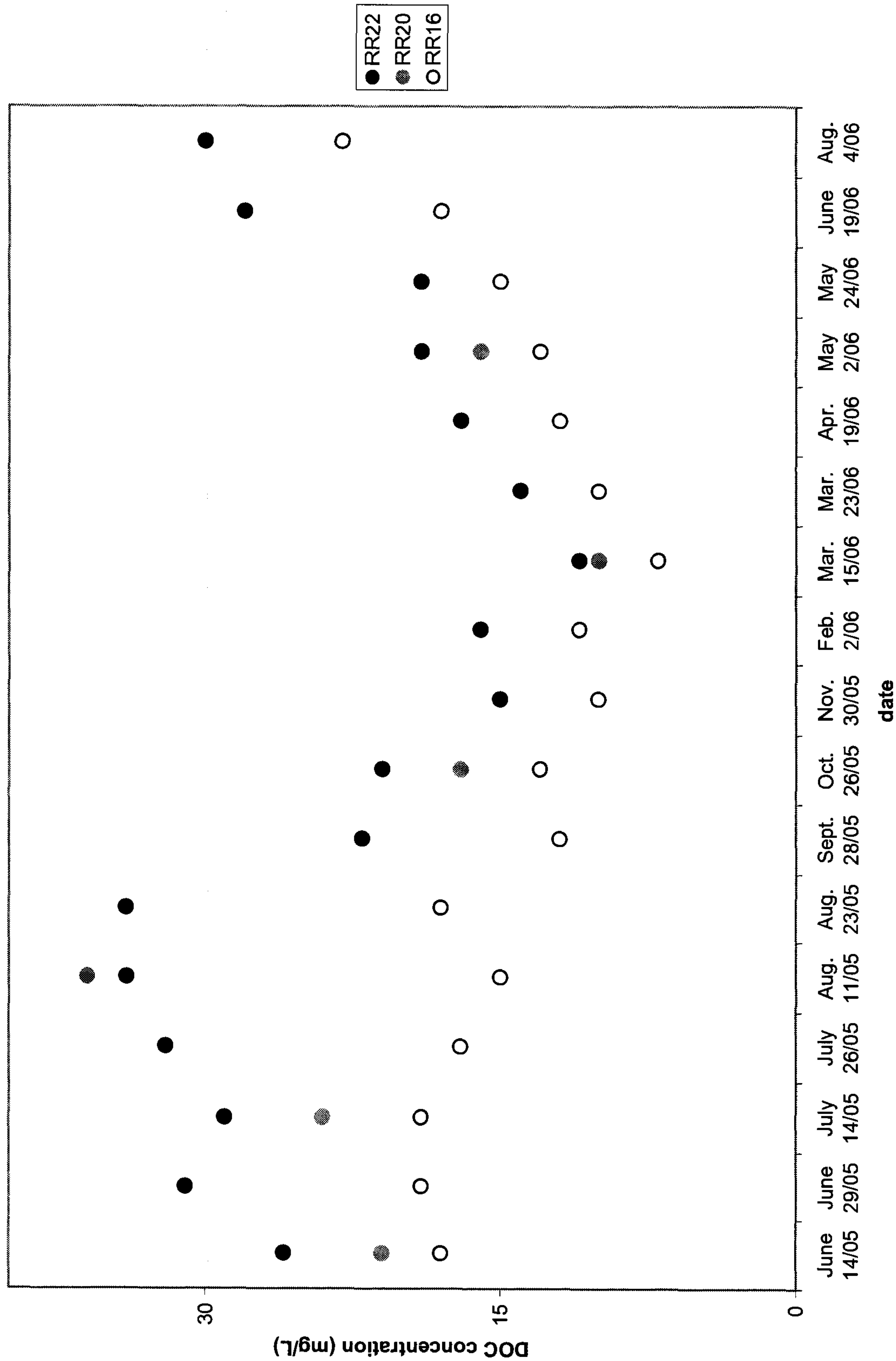
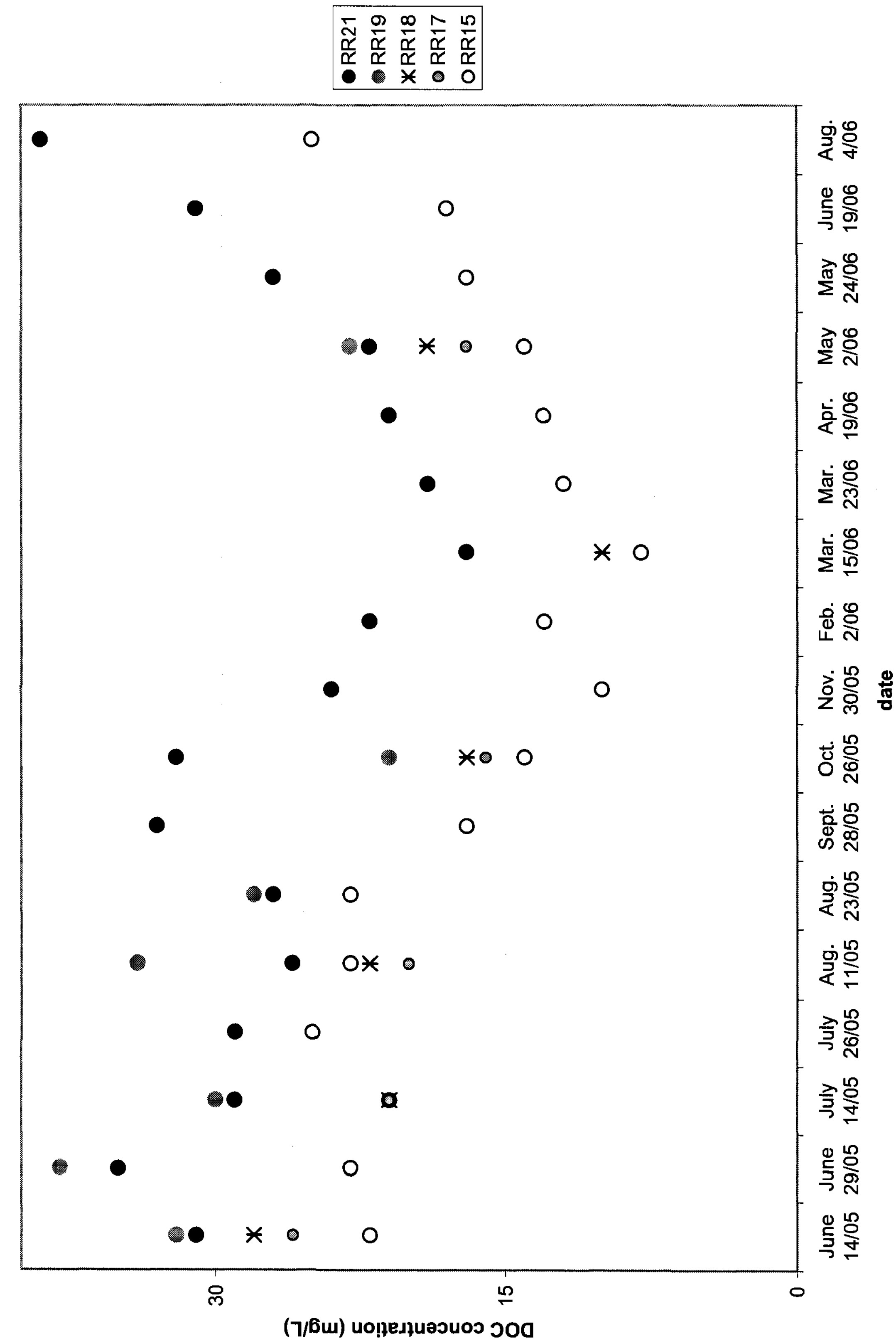

RR1
RR2
RR3
RR4
RR5
sulphate concentration (mg/L)
0
10
20
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 15A. DOC concentrations for the North Division from June 2005 to August 2006.



RR22
RR20
RR16
DOC concentration (mg/L)
0
15
30
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 15B. DOC concentrations for the Main Division from June 2005 to August 2006.



RR21
RR19
RR18
RR17
RR15
DOC concentration (mg/L)
0
15
30
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 15C. DOC concentrations for the North + Main Division from June 2005 to May 2006.

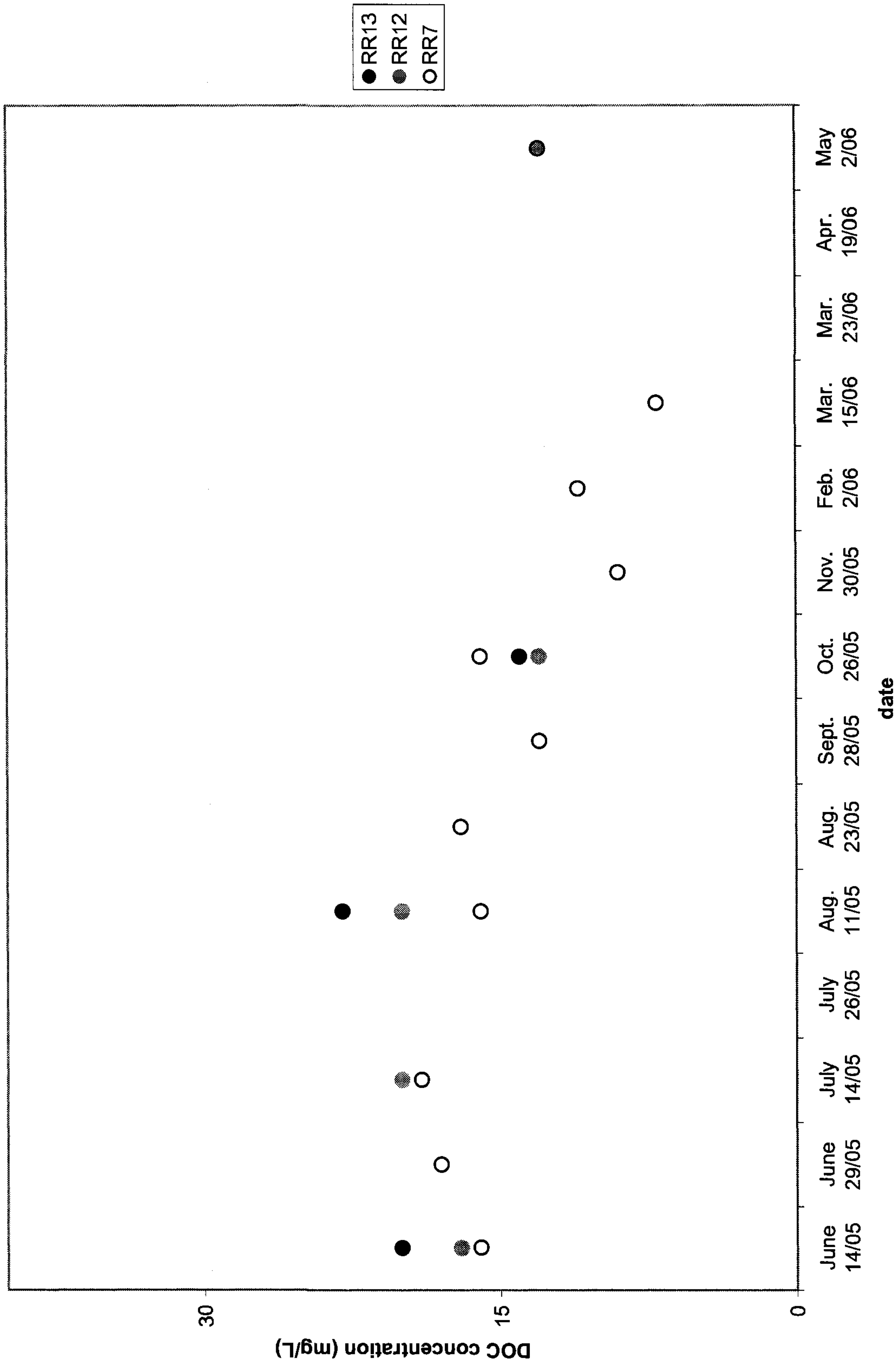
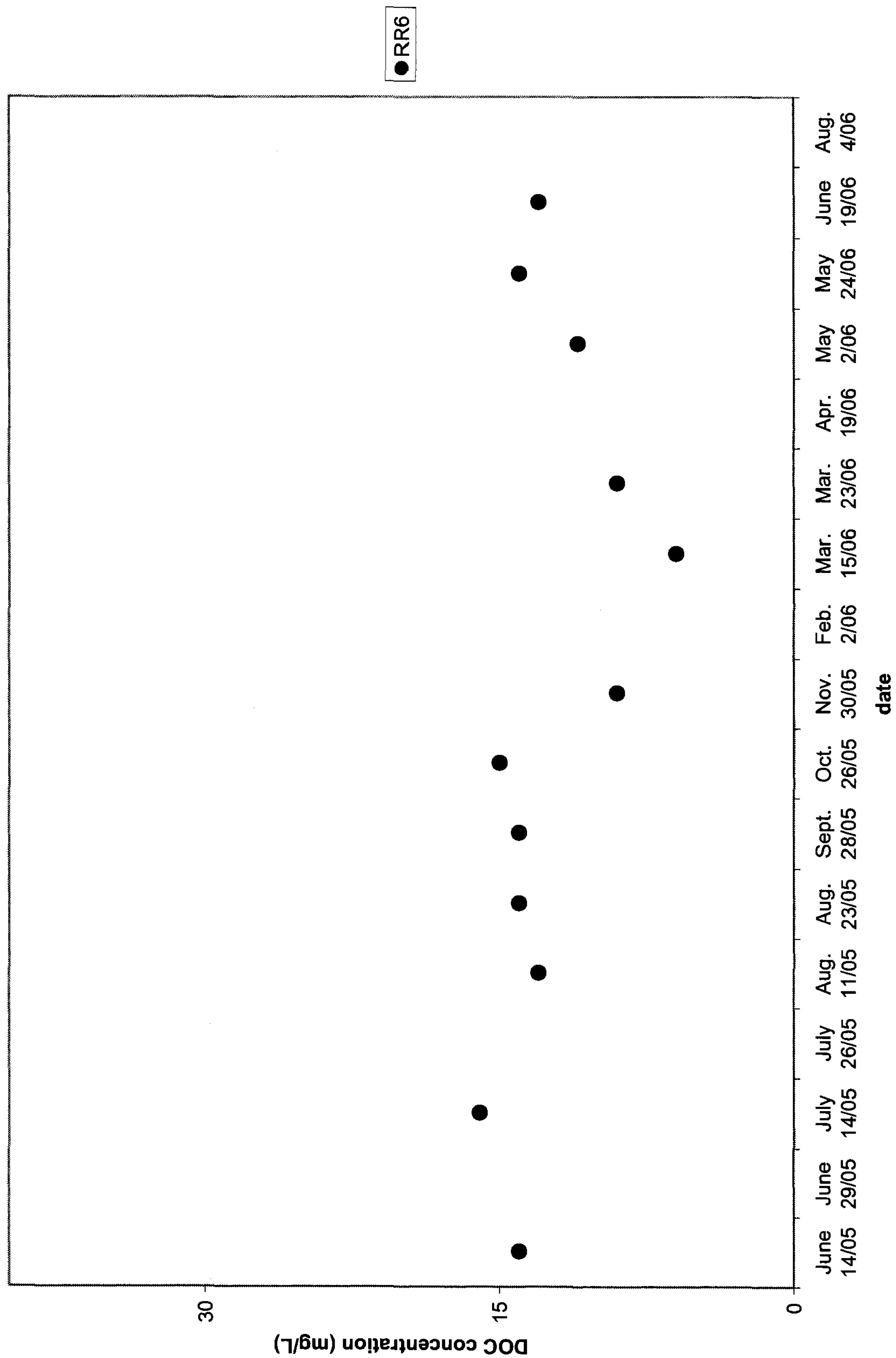

RR13
RR12
RR7
DOC concentration (mg/L)
0
15
30
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date

Figure 15D. DOC concentrations for the Composite Division from June 2005 to August 2006.



RR6
DOC concentration (mg/L)
0
15
30
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 15E. DOC concentrations for the South Division from June 2005 to August 2006.

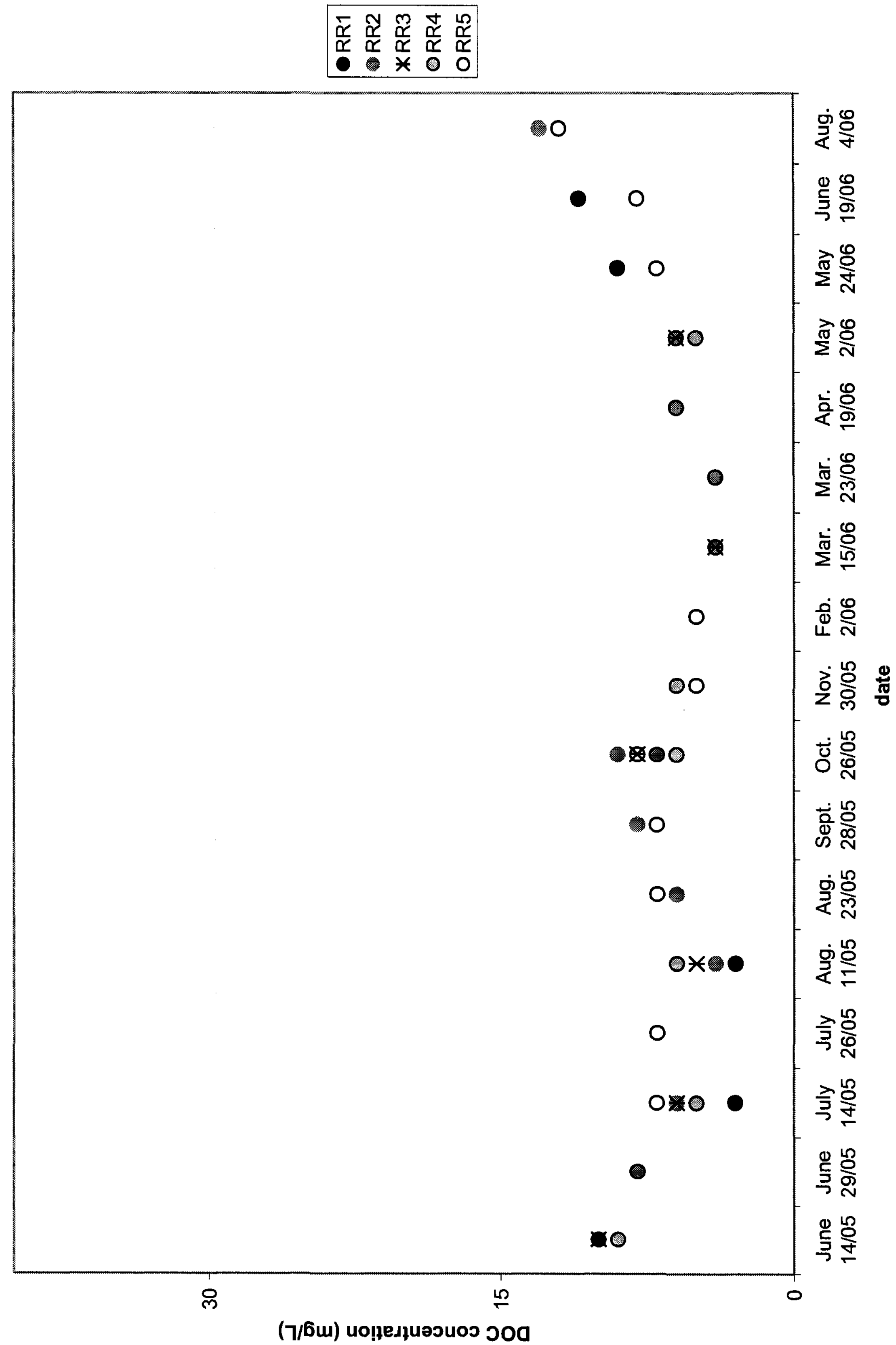

RR1
RR2
RR3
RR4
RR5
DOC concentration (mg/L)
0
15
30
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 16A. DIC concentrations for the North Division from June 2005 to August 2006.

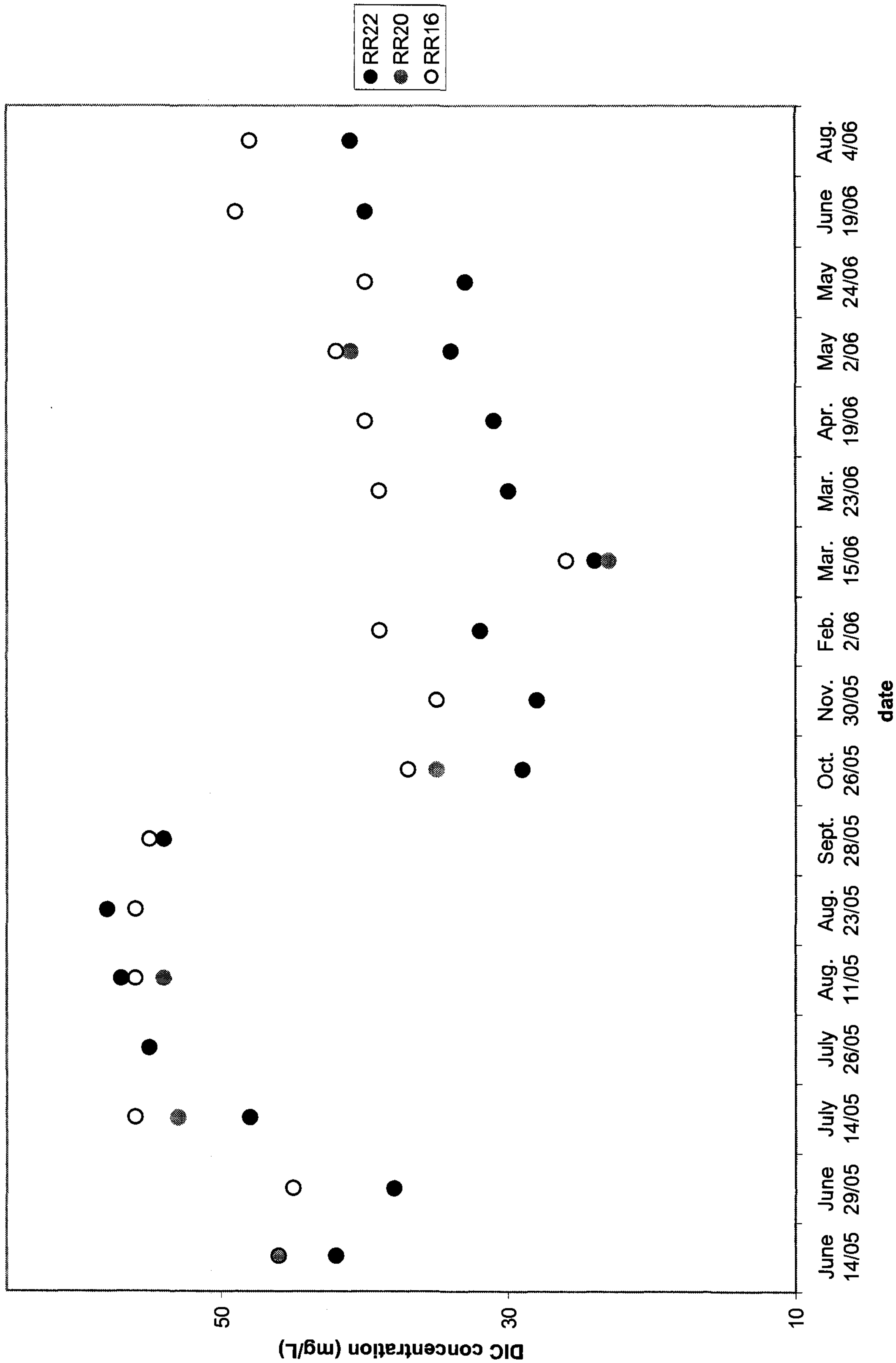
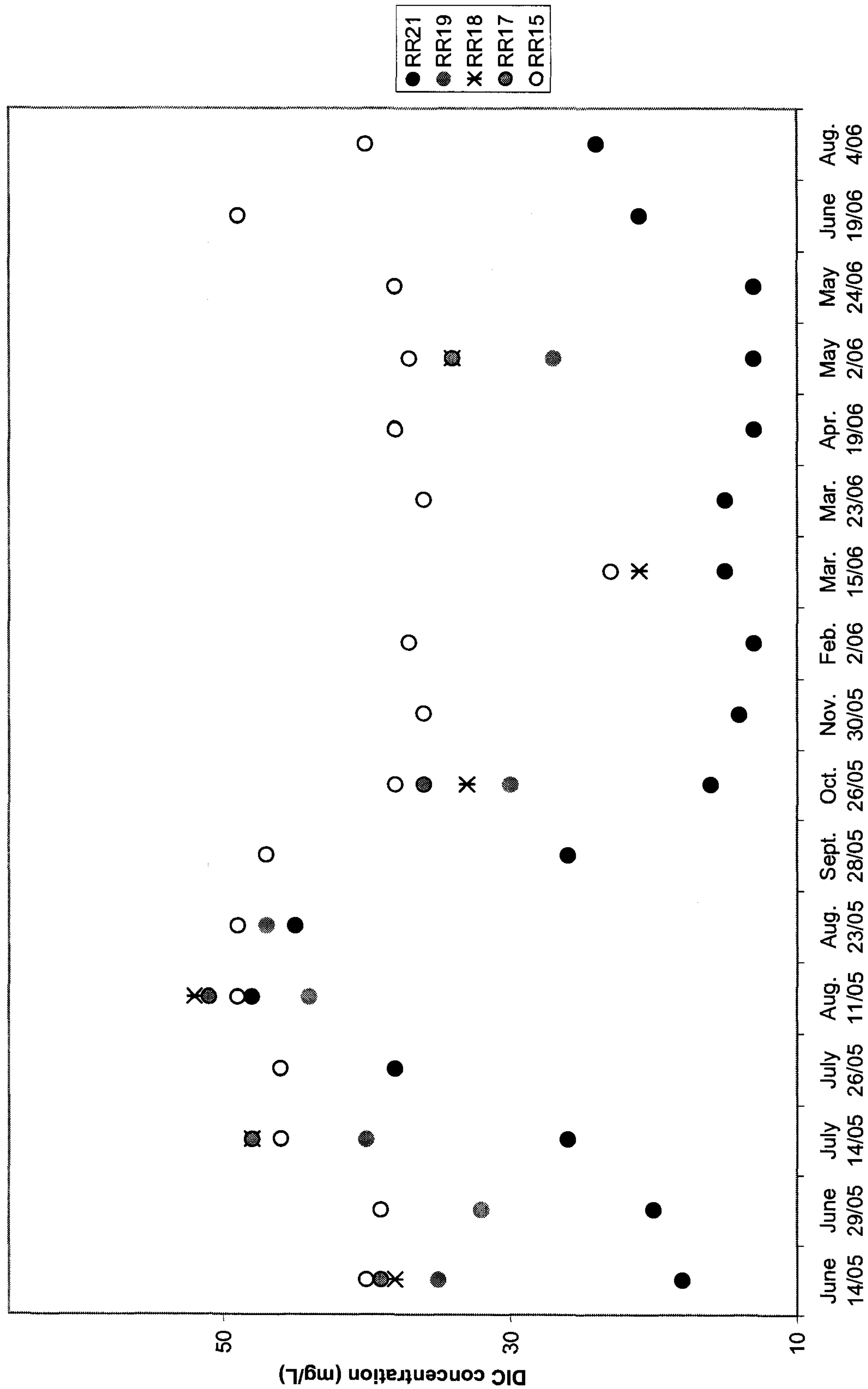

RR22
RR20
RR16
DIC concentration (mg/L)
10
30
50
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 16B. DIC concentrations for the Main Division from June 2005 to August 2006.



RR21
RR19
RR18
RR17
RR15
DIC concentration (mg/L)
10
30
50
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 16C. DIC concentrations for the North + Main Division from June 2005 to May 2006.

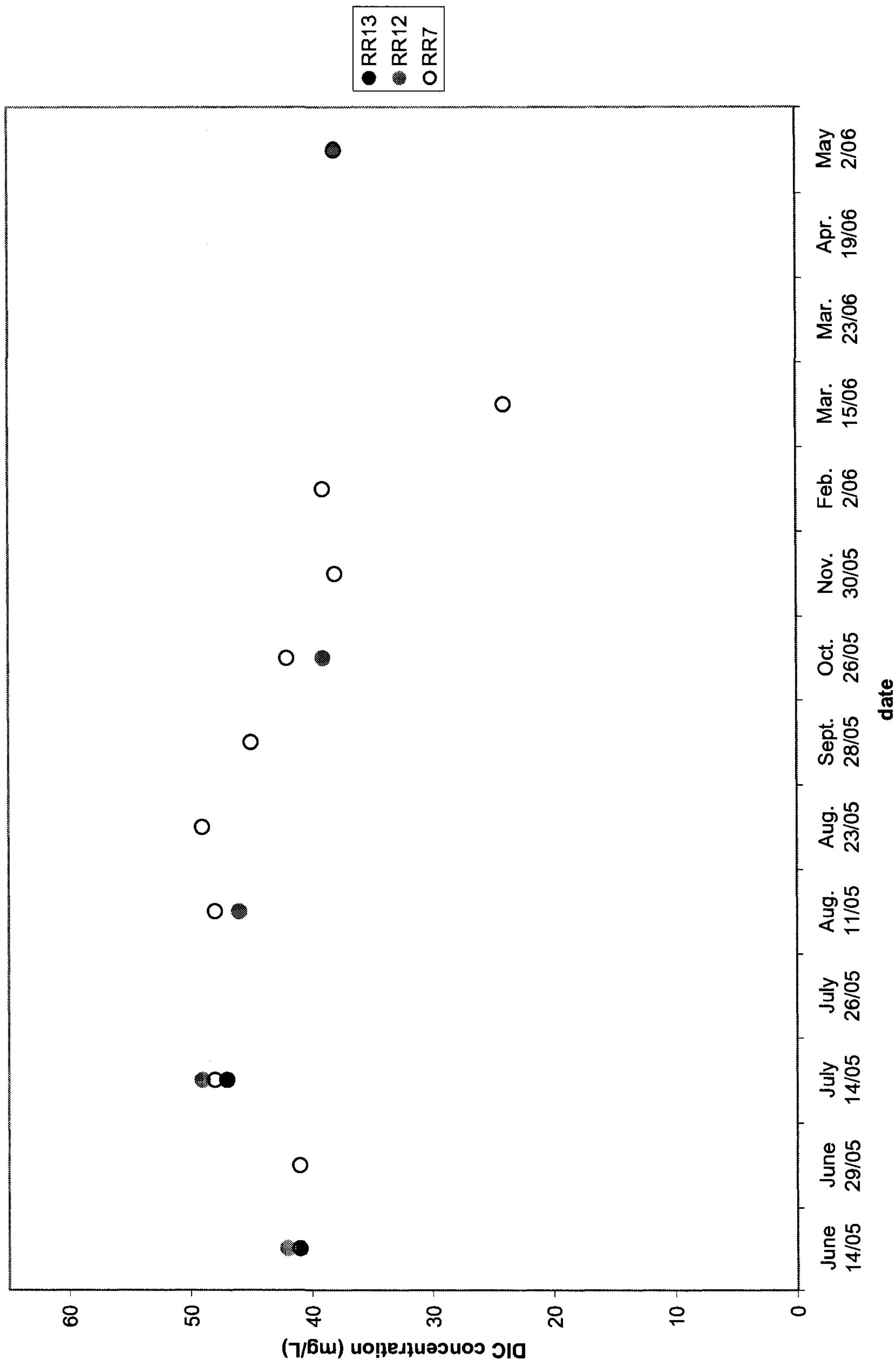

RR13
RR12
RR7
DIC concentration (mg/L)
0
10
20
30
40
50
60
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date

Figure 16D. DIC concentrations for the Composite Division from June 2005 to August 2006.

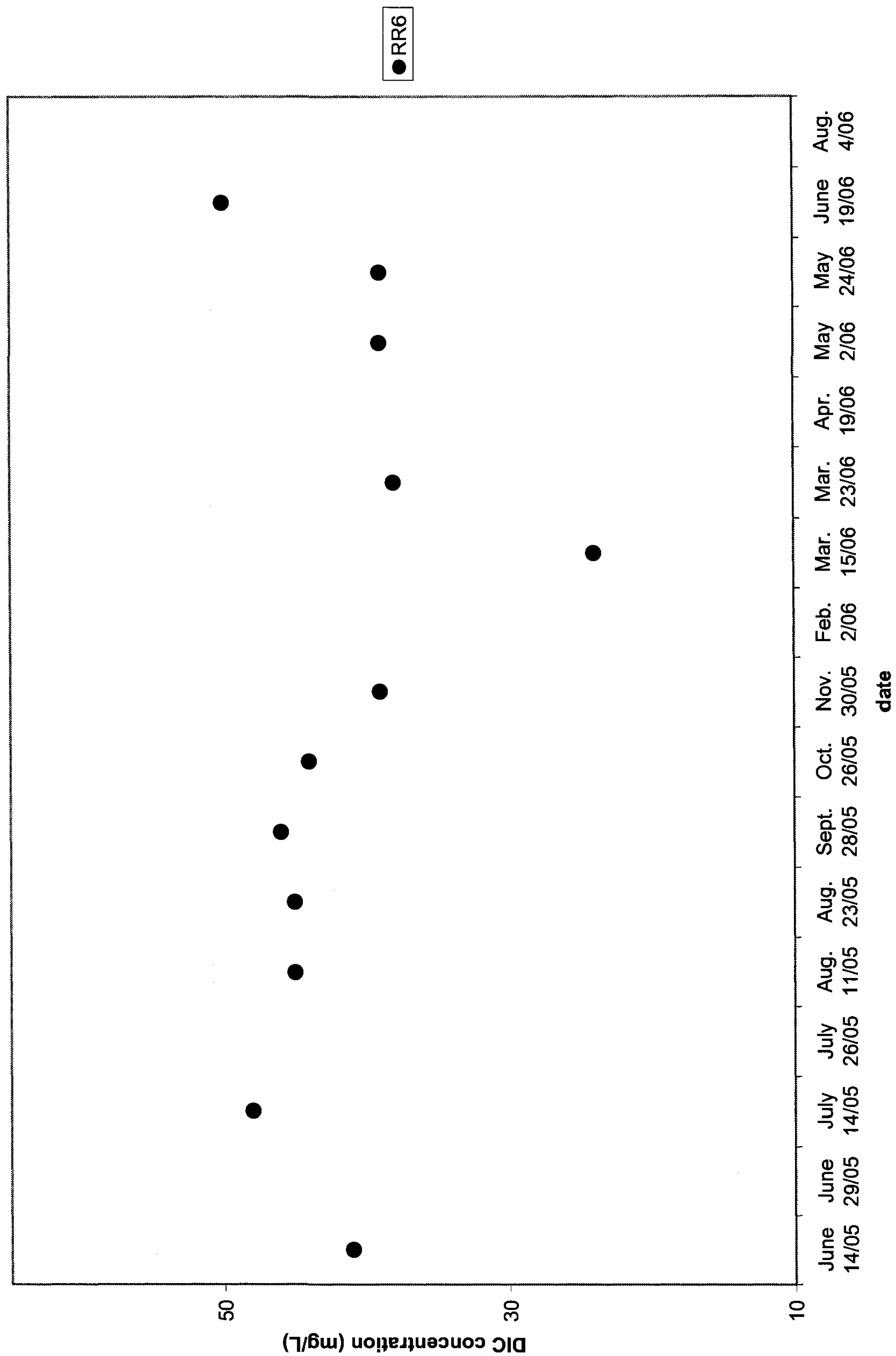
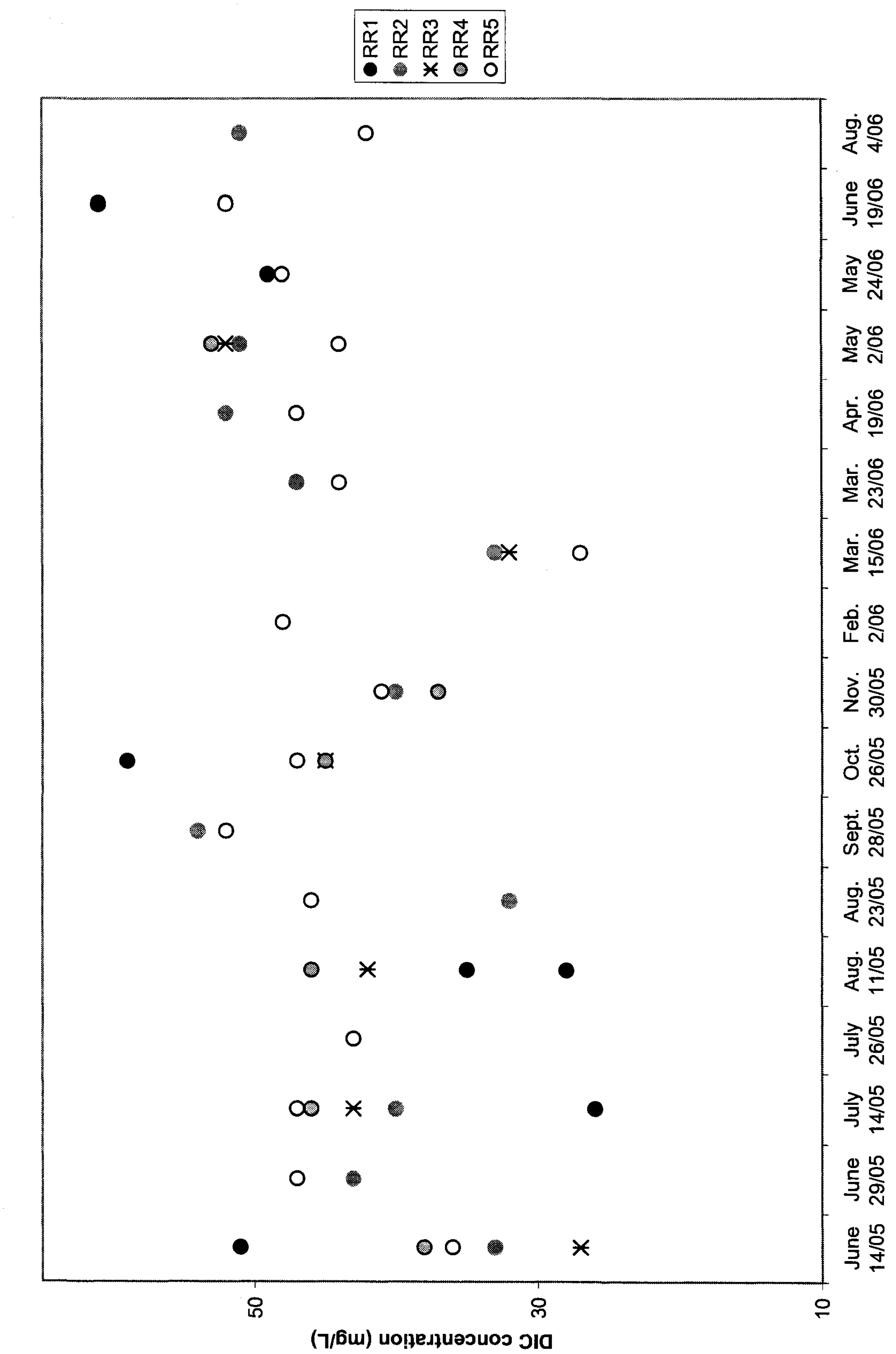
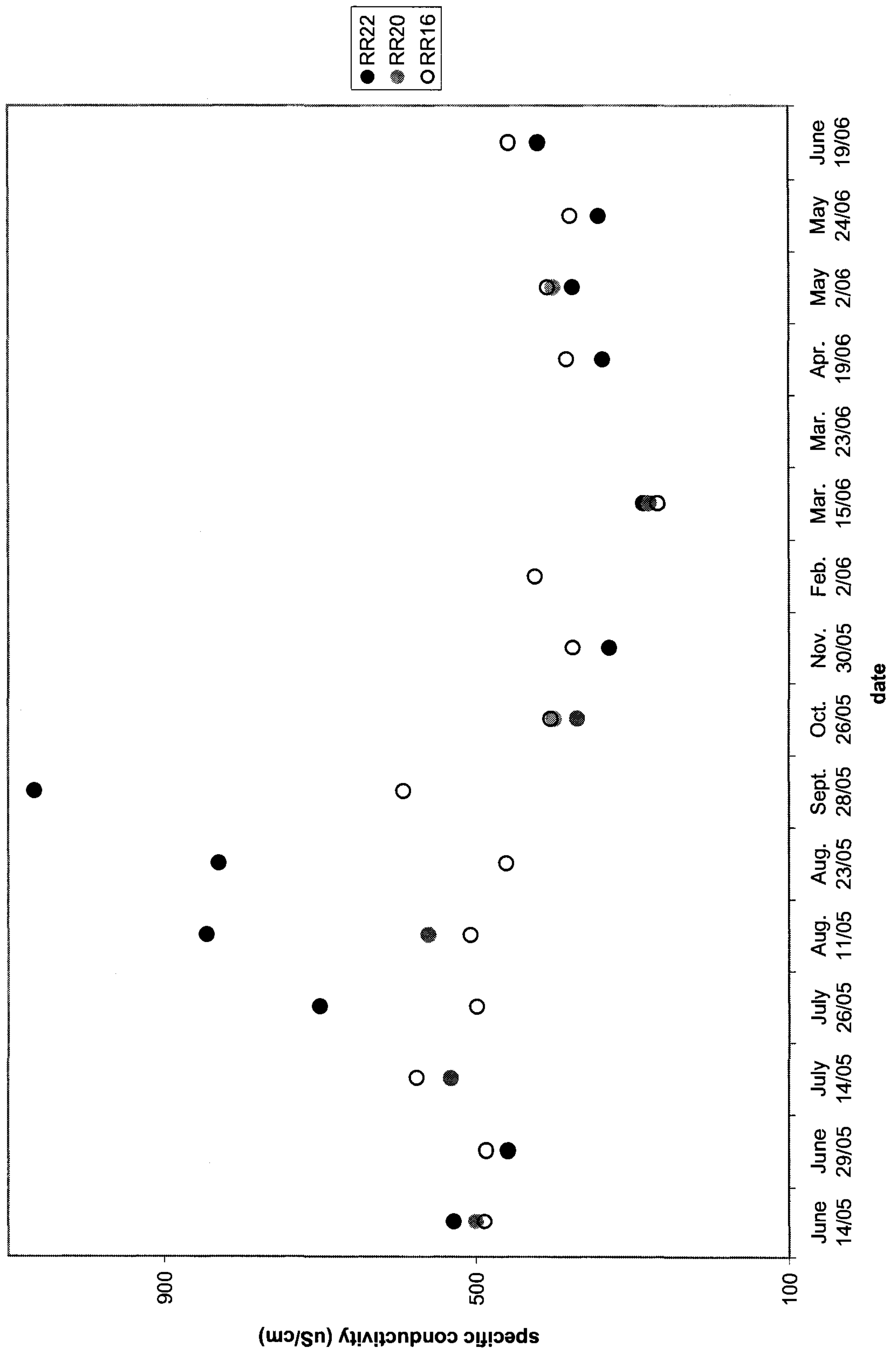

RR6
DIC concentration (mg/L)
50
30
10
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 16E. DIC concentrations for the South Division from June 2005 to August 2006.



RR1
RR2
RR3
RR4
RR5
DIC concentration (mg/L)
10
30
50
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 17A. Specific conductivity shown for the North Division from June 2005 to 2006.



RR22
RR20
RR16
specific conductivity (uS/cm)
900
500
100
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
date

Figure 17B. Specific conductivity shown for the Main Division from June 2005 to 2006.

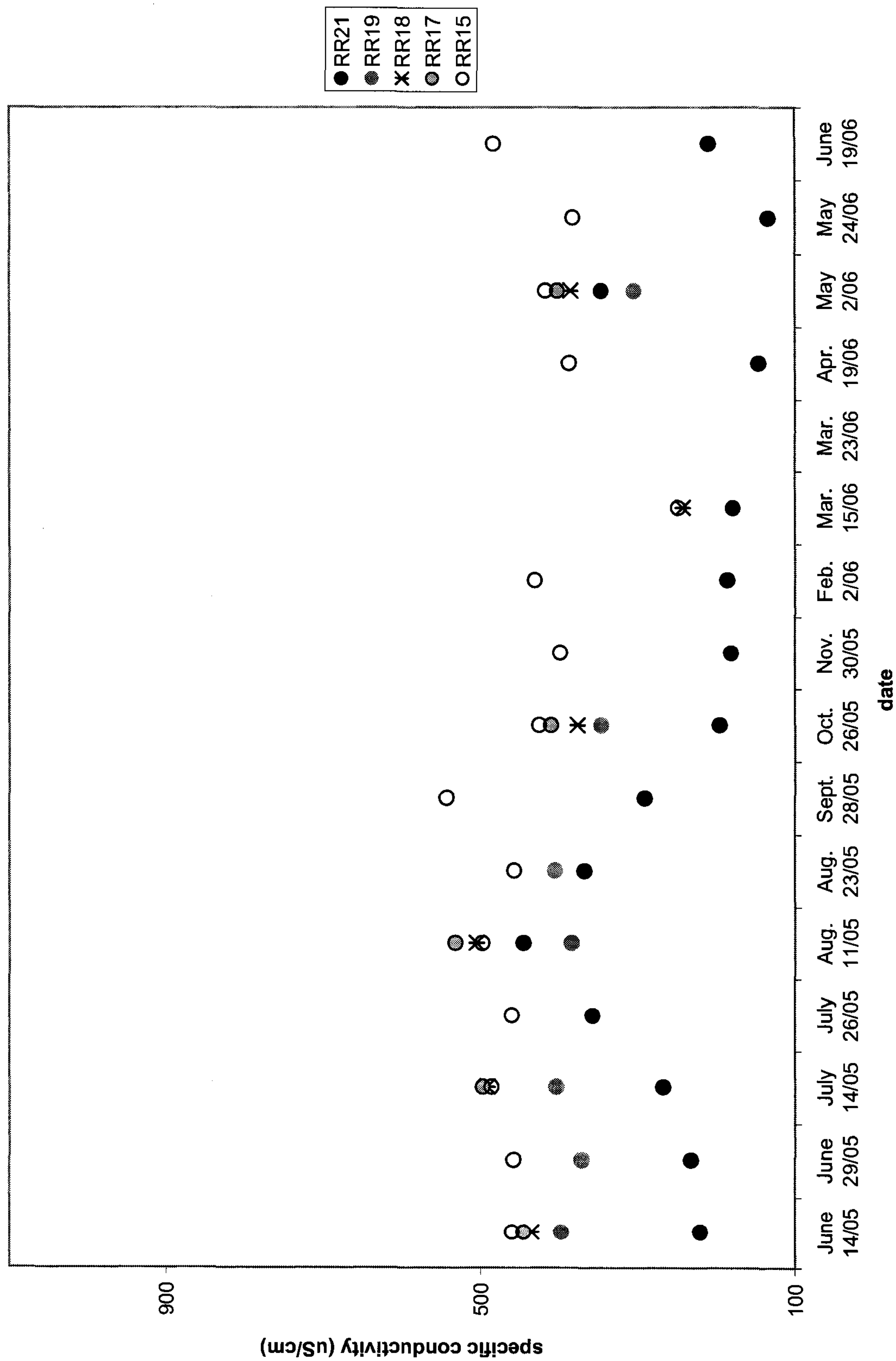

RR21
RR19
RR18
RR17
RR15
specific conductivity (uS/cm)
900
500
100
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
date

Figure 17C. Specific conductivity shown for the North + Main Division from June 2005 to May 2006.

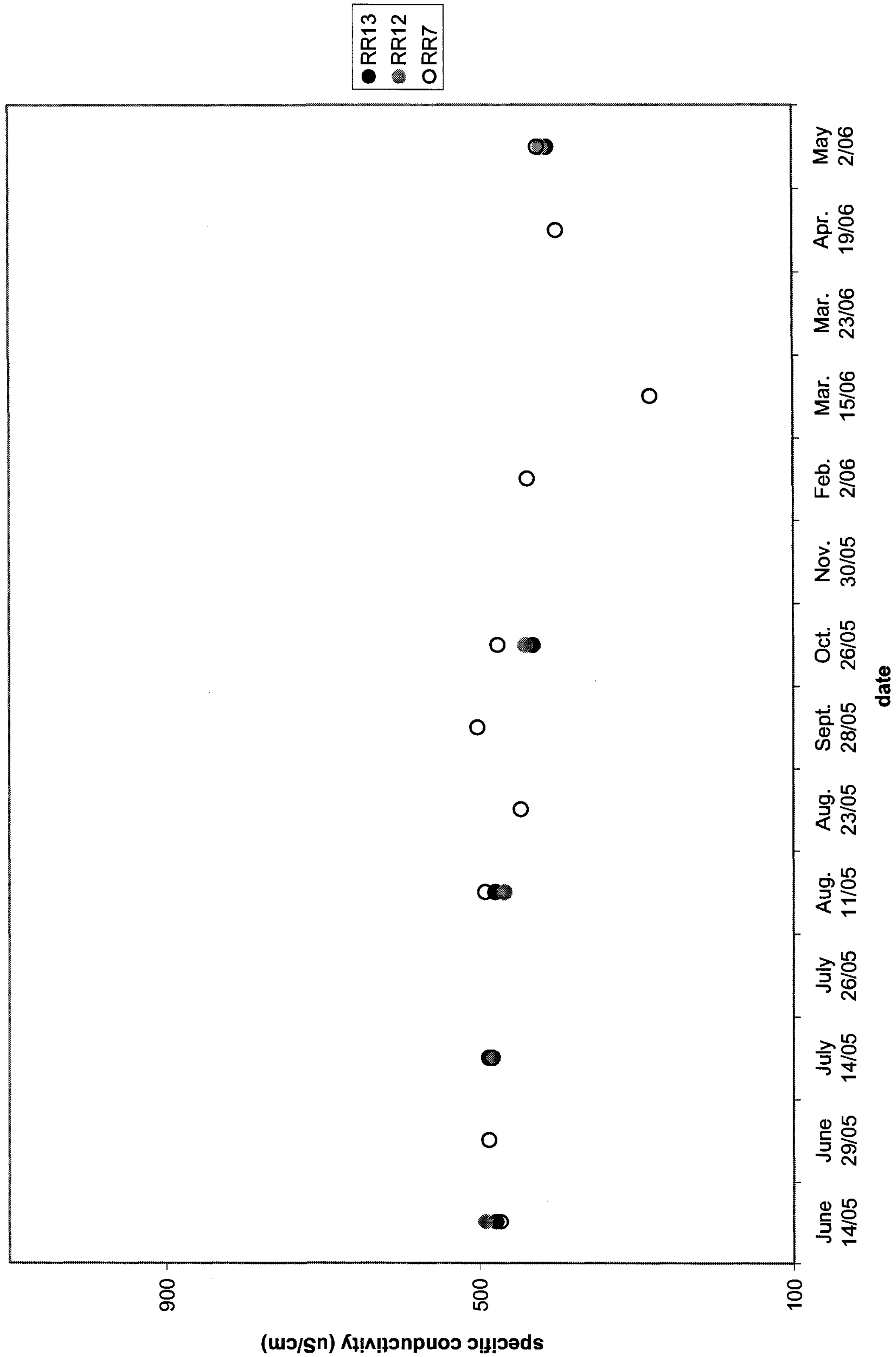

RR13
RR12
RR7
specific conductivity (uS/cm)
900
500
100
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06

Figure 17D. Specific conductivity shown for the Composite Division from June 2005 to 2006.

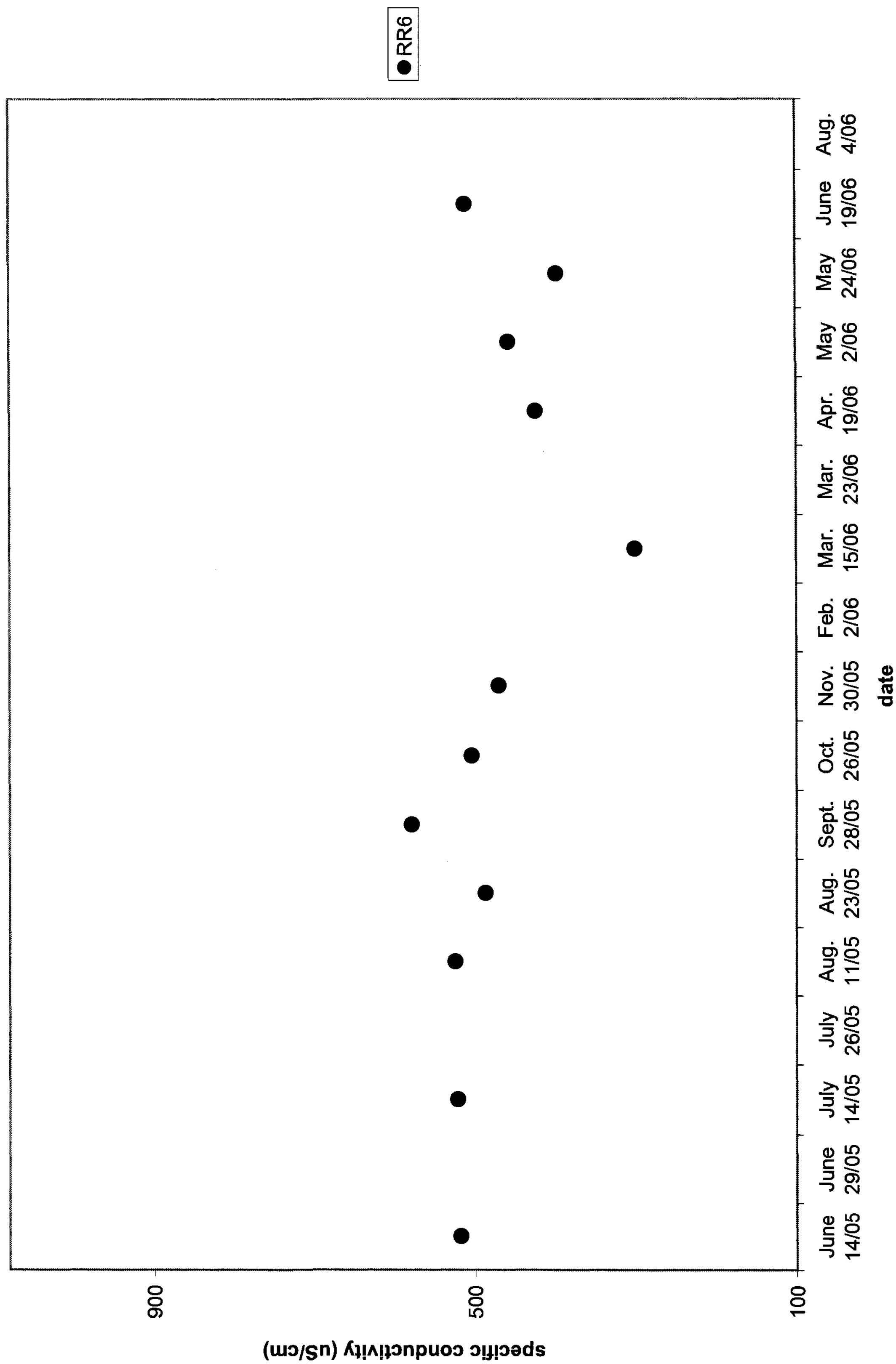

RR6
specific conductivity (uS/cm)
100
500
900
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 17E. Specific conductivity shown for the South Division from June 2005 to 2006.

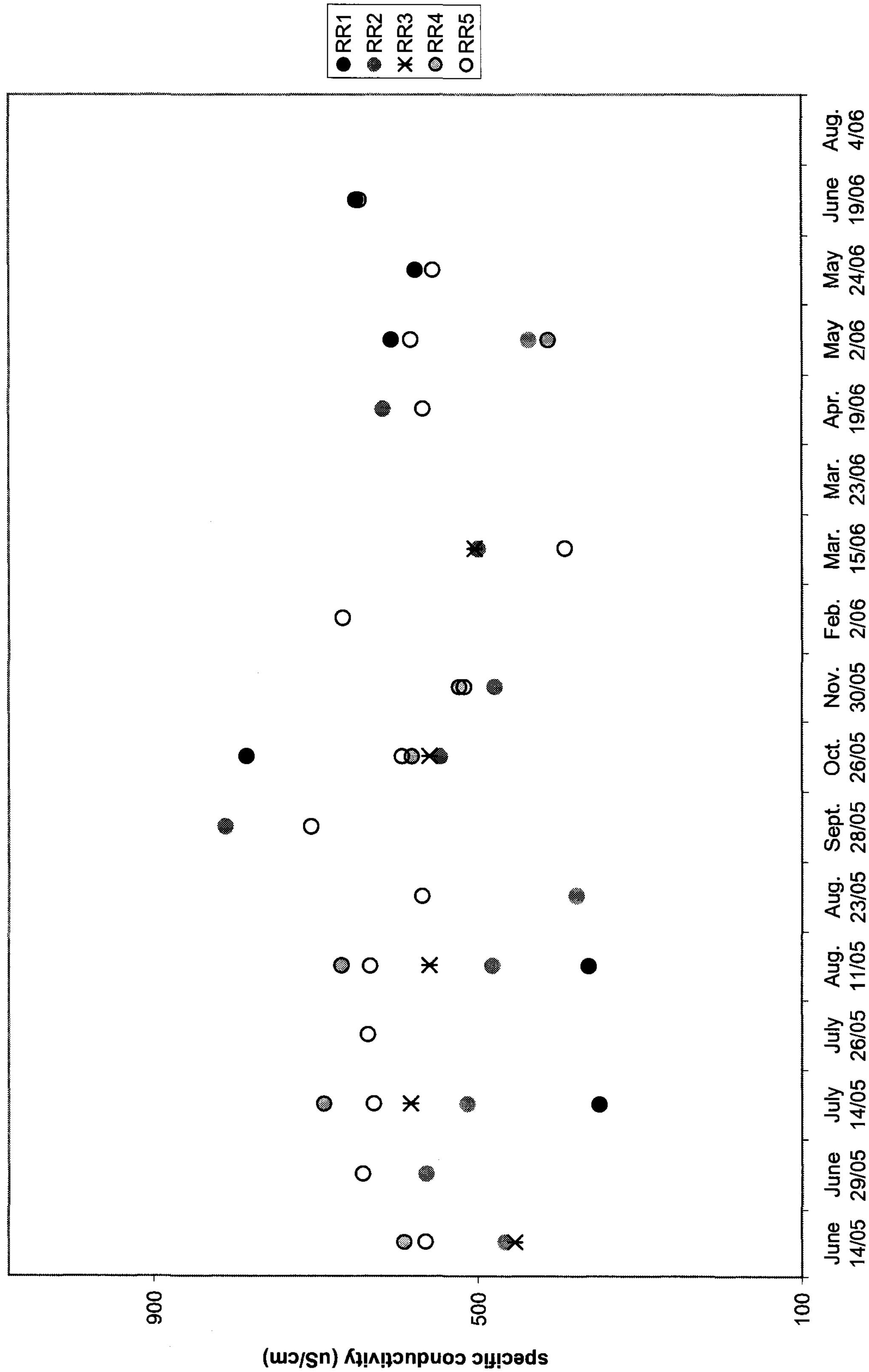
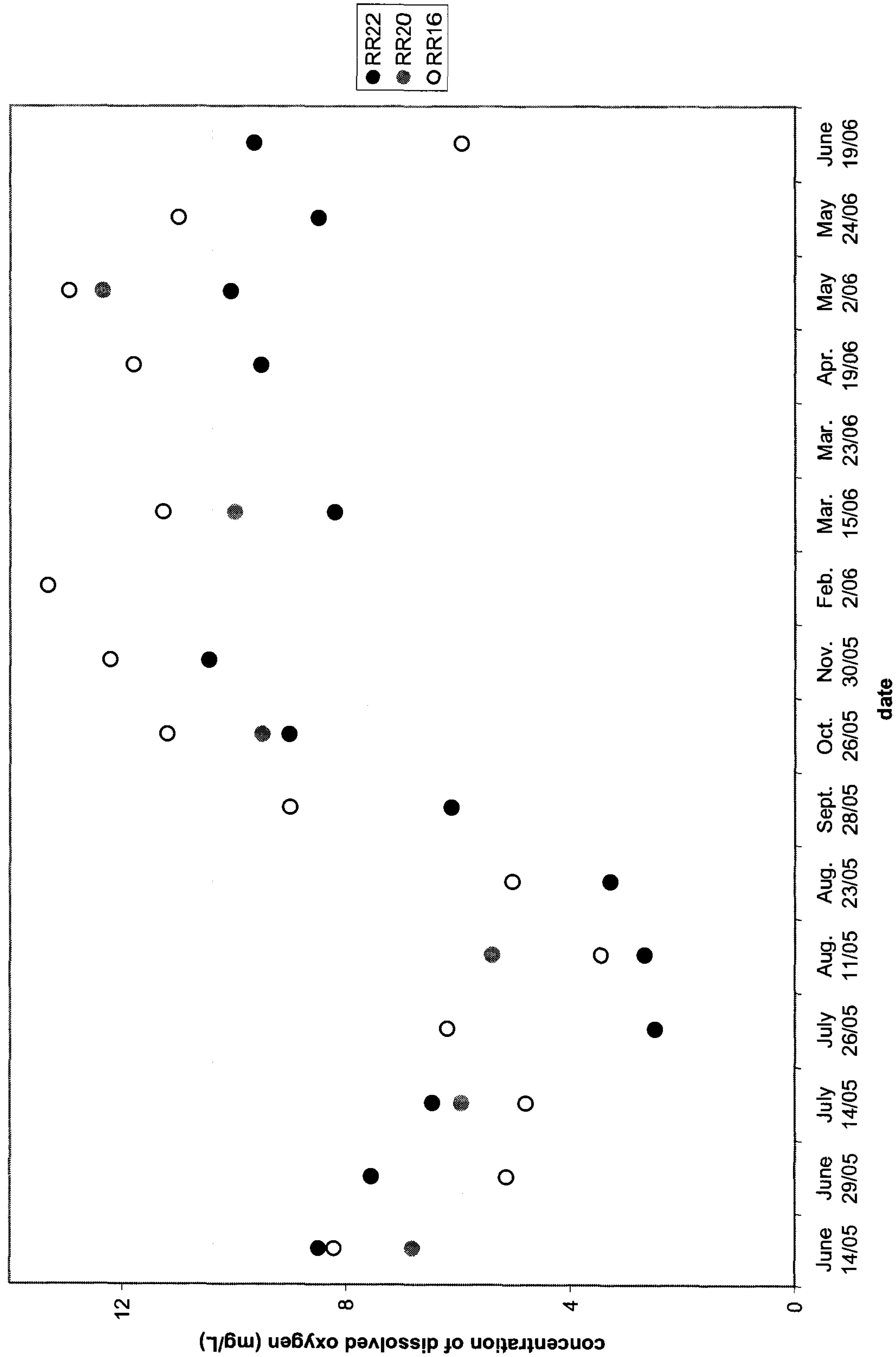

RR1
RR2
RR3
RR4
RR5
specific conductivity (uS/cm)
900
500
100
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06
date

Figure 18A. Dissolved oxygen concentrations for the North Division from June 2005 to 2006.



RR22
RR20
RR16
concentration of dissolved oxygen (mg/L)
0
4
8
12
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06

Figure 18B. Dissolved oxygen concentrations for the Main Division from June 2005 to 2006.

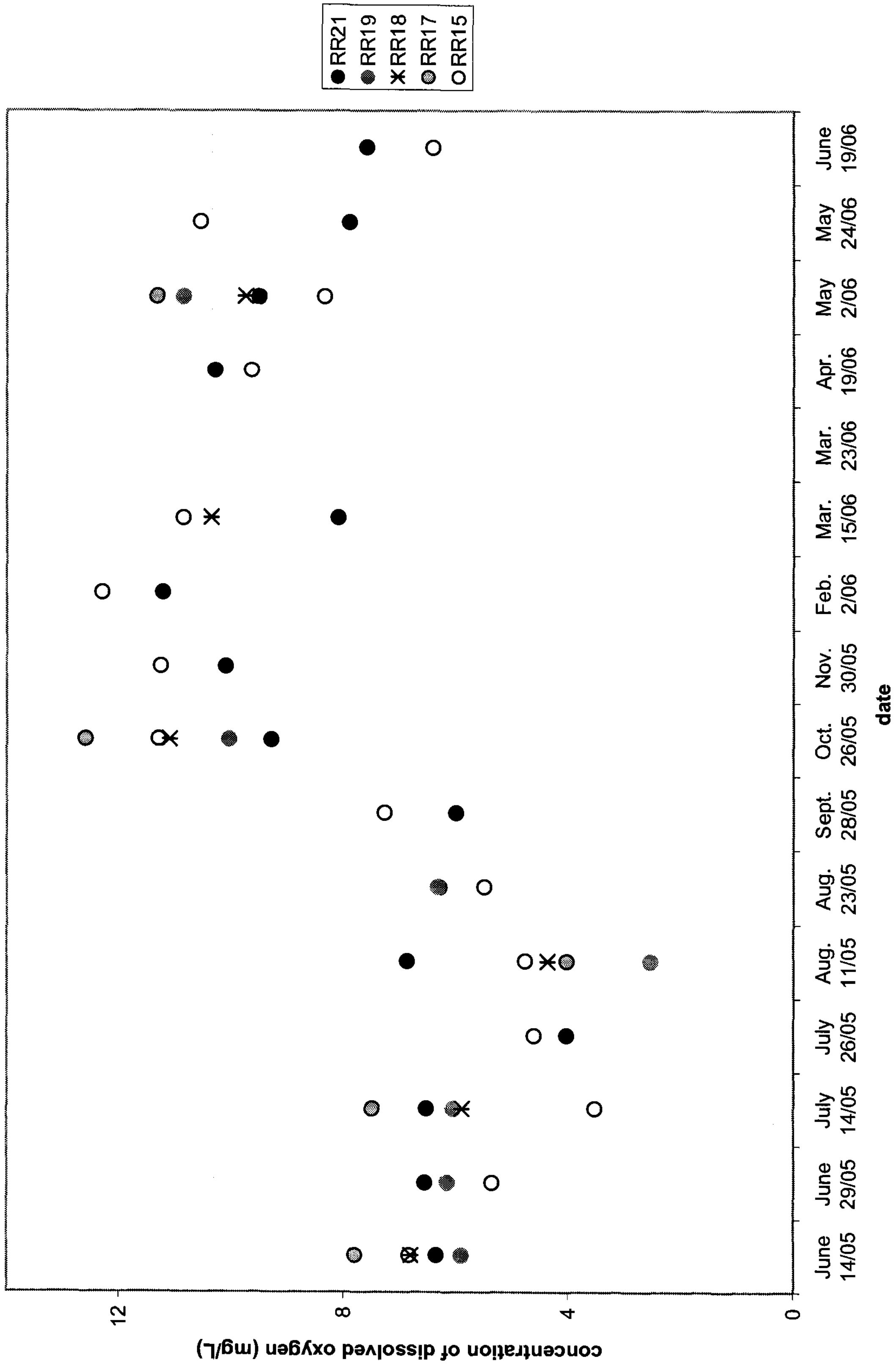
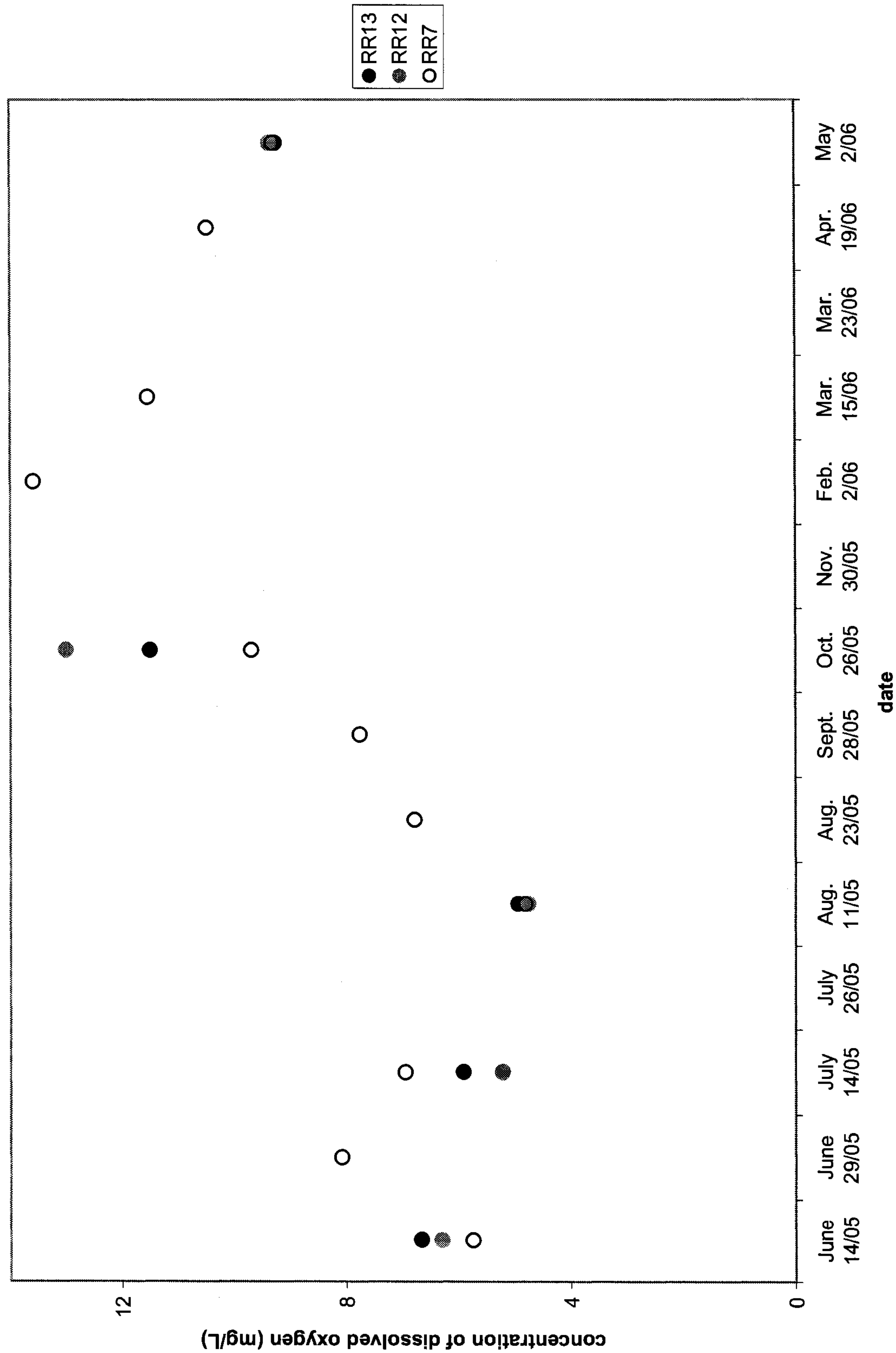

RR21
RR19
RR18
RR17
RR15
concentration of dissolved oxygen (mg/L)
0
4
8
12
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06

Figure 18C. Dissolved oxygen concentrations for the North + Main Division from June 2005 to May 2006.



RR13
RR12
RR7
concentration of dissolved oxygen (mg/L)
0
4
8
12
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06

Figure 18D. Dissolved oxygen concentrations for the Composite Division from June 2005 to 2006.

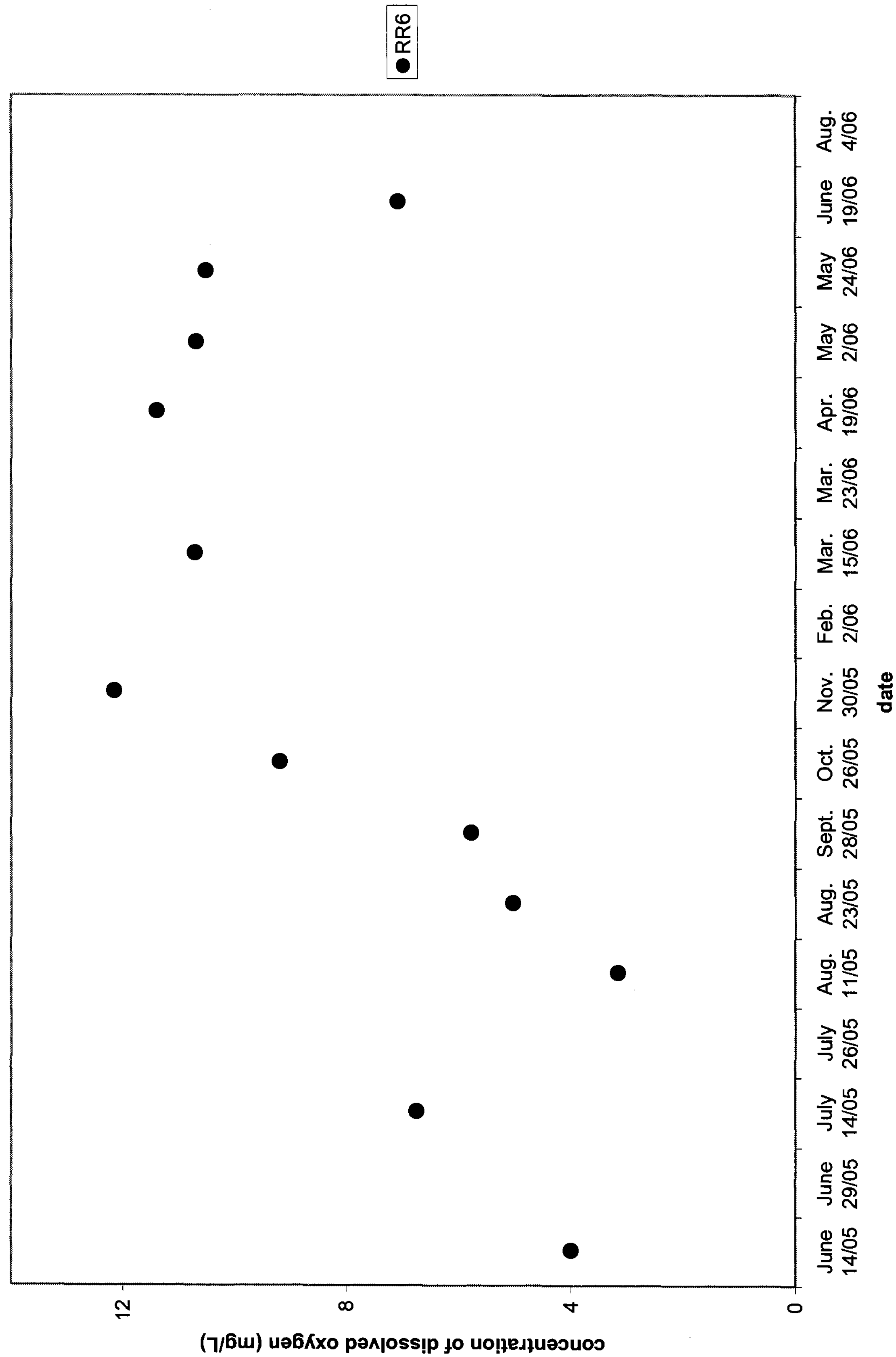

RR6
concentration of dissolved oxygen (mg/L)
0
4
8
12
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 18E. Dissolved oxygen concentrations for the South Division from June 2005 to 2006.

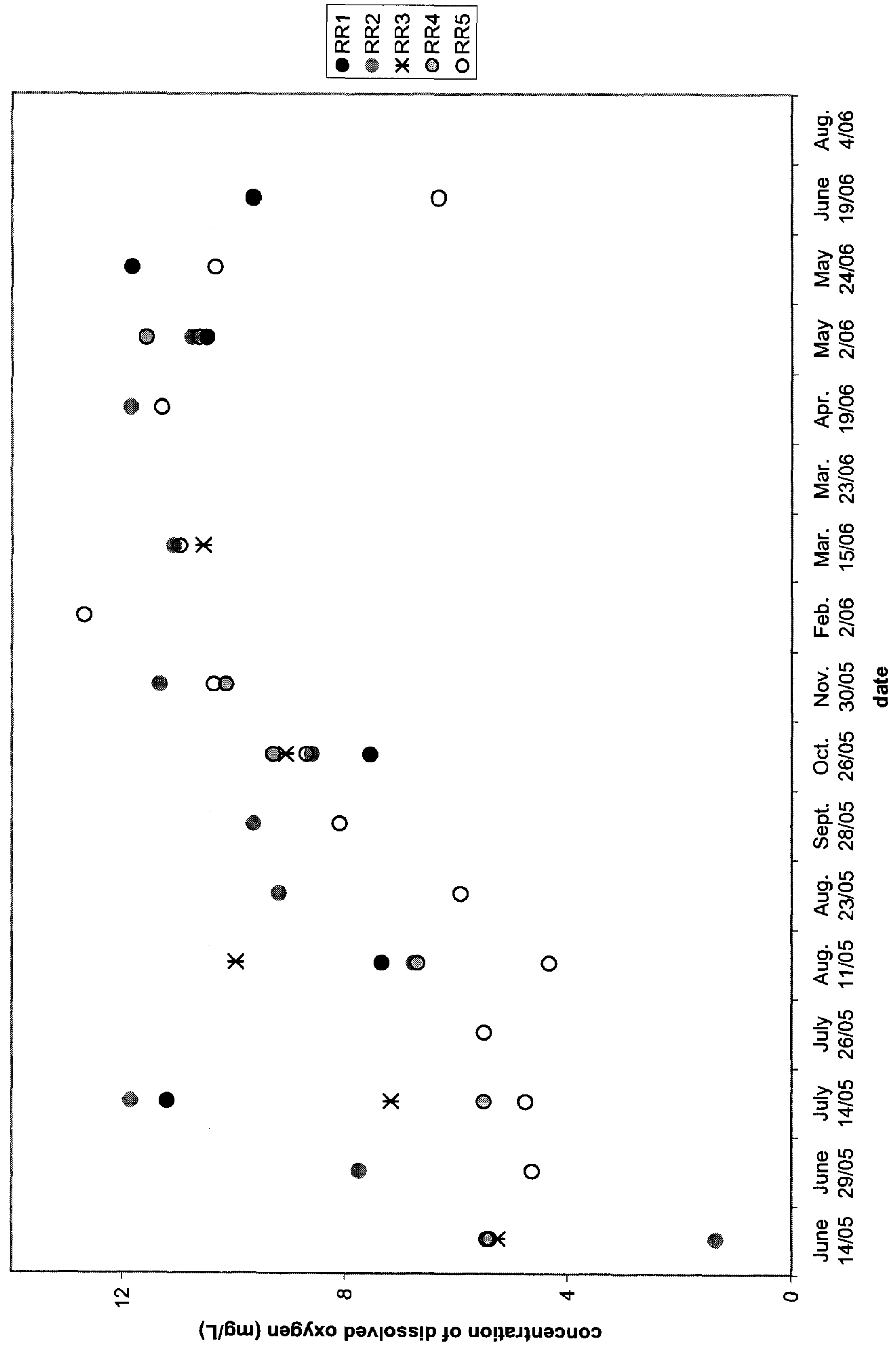

RR1
RR2
RR3
RR4
RR5
concentration of dissolved oxygen (mg/L)
0
4
8
12
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 19A. Percentages of dissolved oxygen saturation for the North Division from June 2005 to 2006.

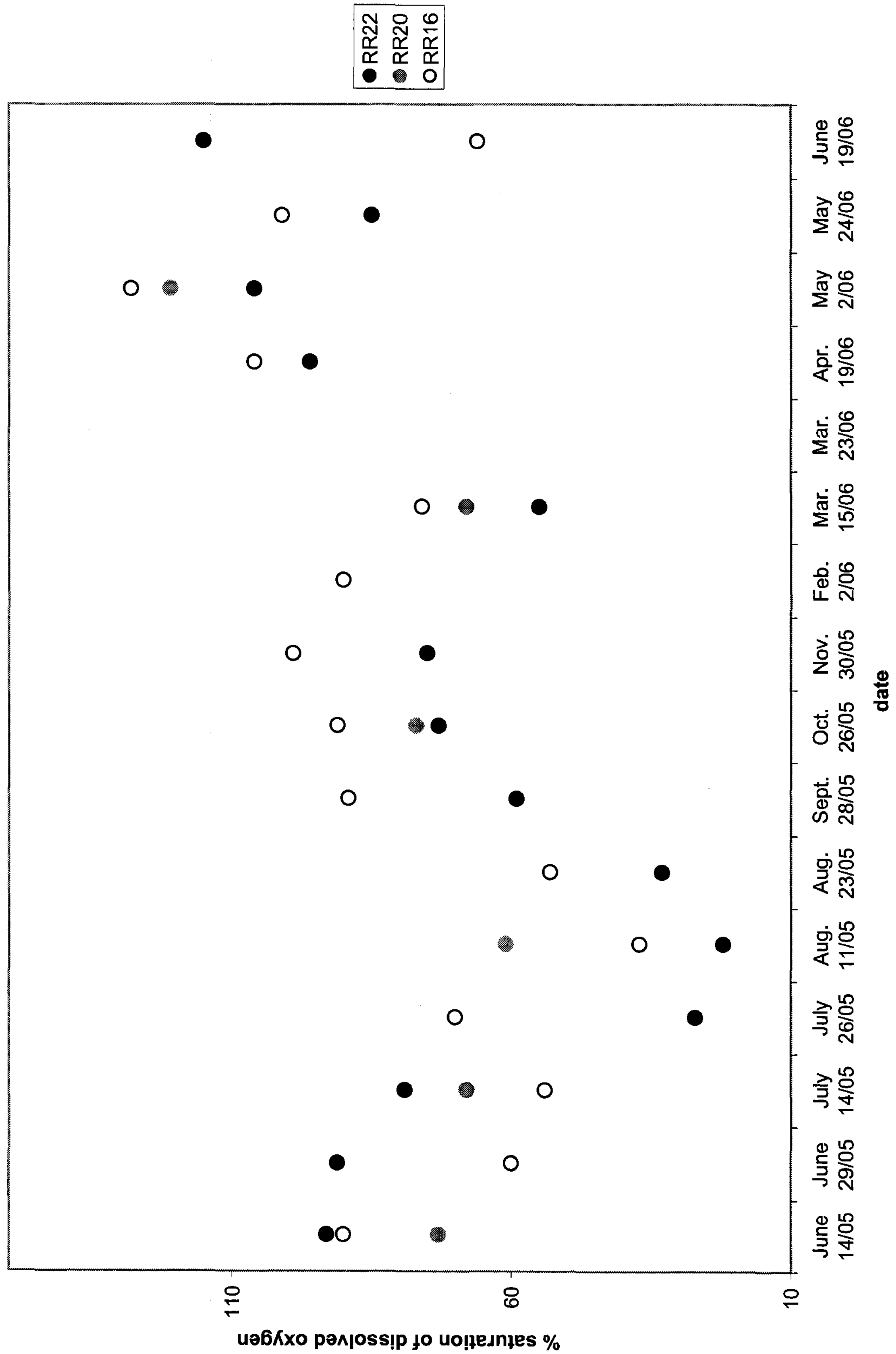

RR22
RR20
RR16
% saturation of dissolved oxygen
110
60
10
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06

Figure 19B. Percentages of dissolved oxygen saturation for the Main Division from June 2005 to 2006.

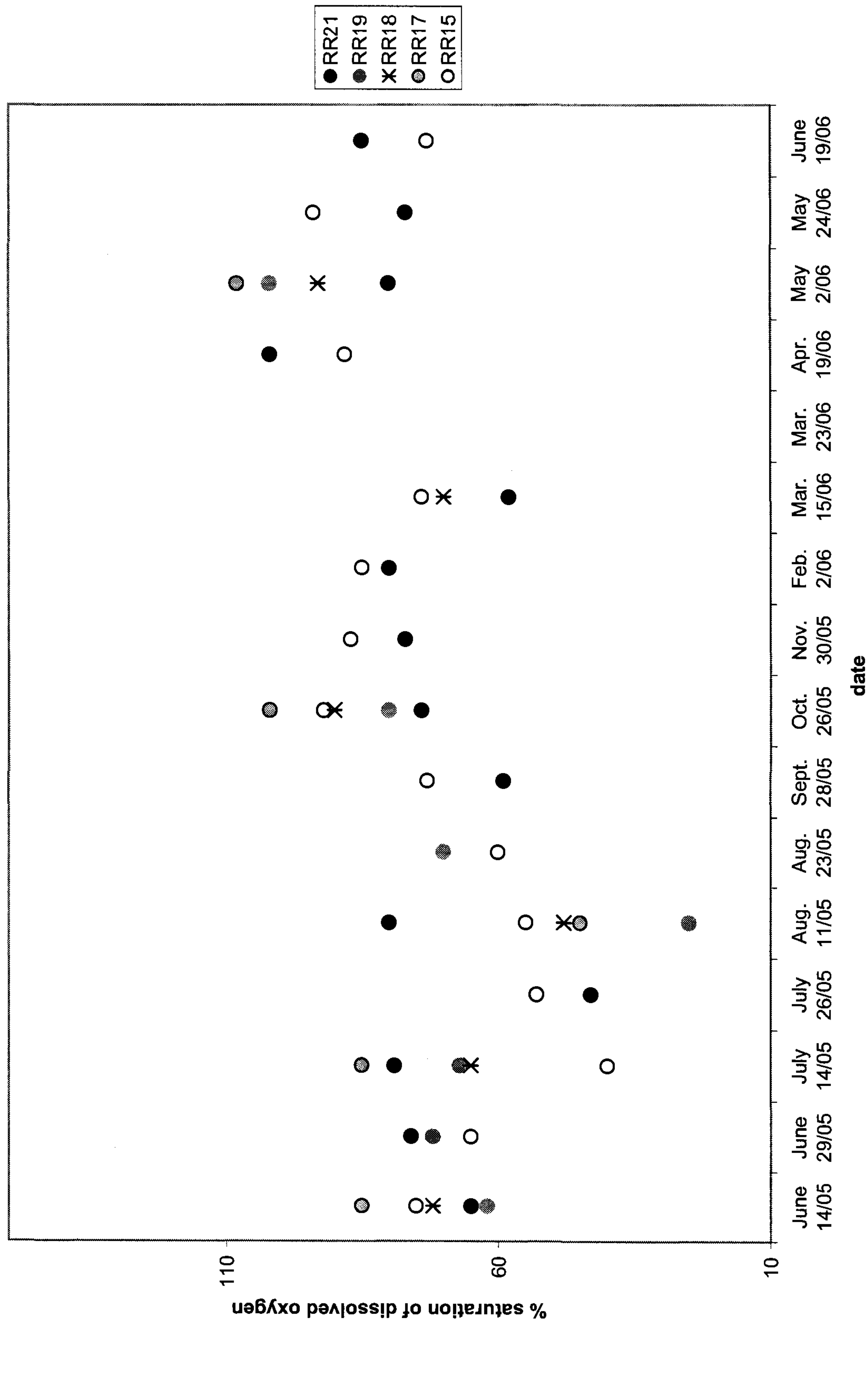

RR21
RR19
RR18
RR17
RR15
% saturation of dissolved oxygen
110
60
10
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
date

Figure 19C. Percentages of dissolved oxygen saturation for the North + Main Division from June 2005 to May 2006.

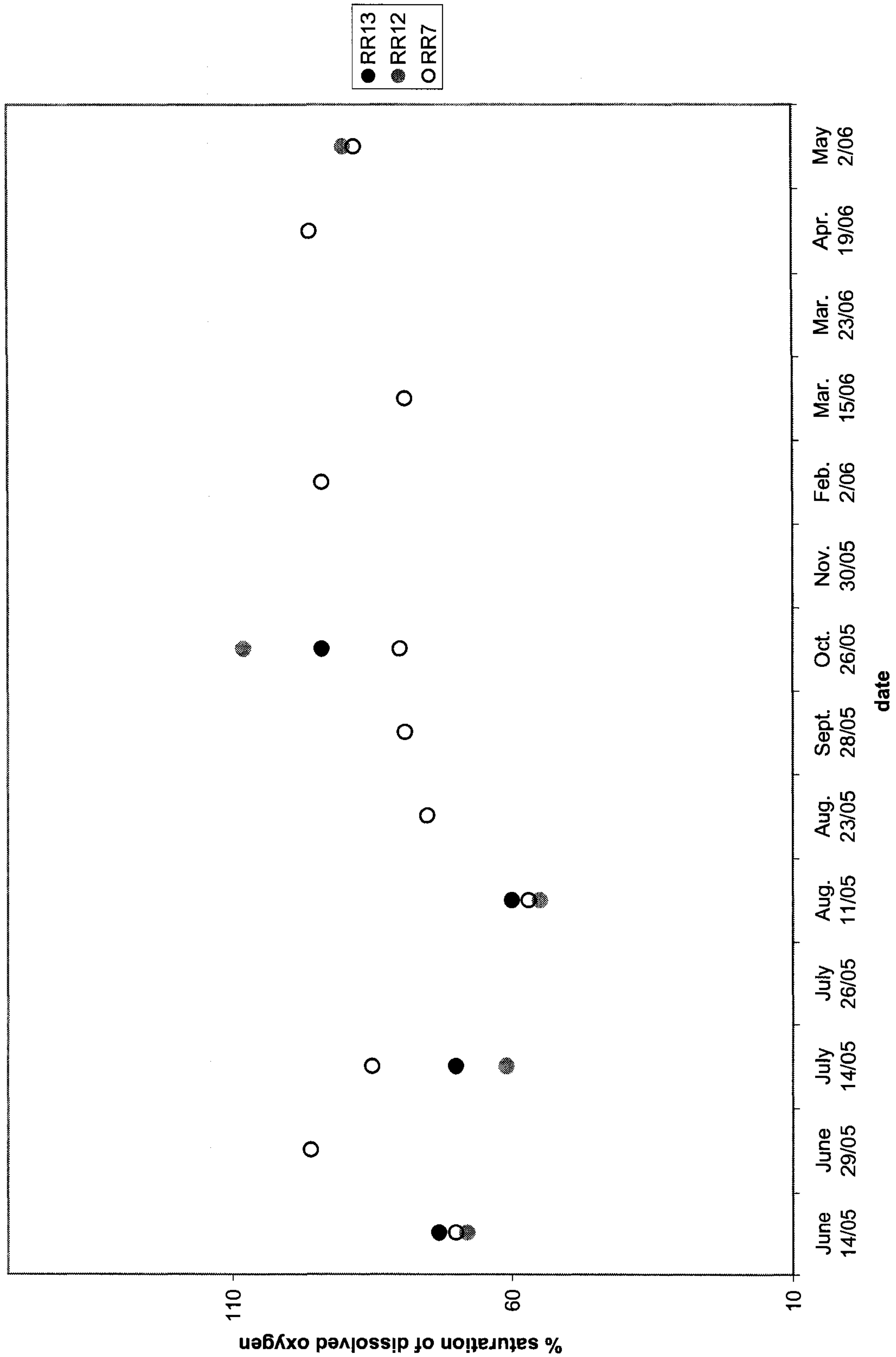

RR13
RR12
RR7
% saturation of dissolved oxygen
110
60
10
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
date

Figure 19D. Percentages of dissolved oxygen saturation for the Composite Division from June 2005 to 2006.

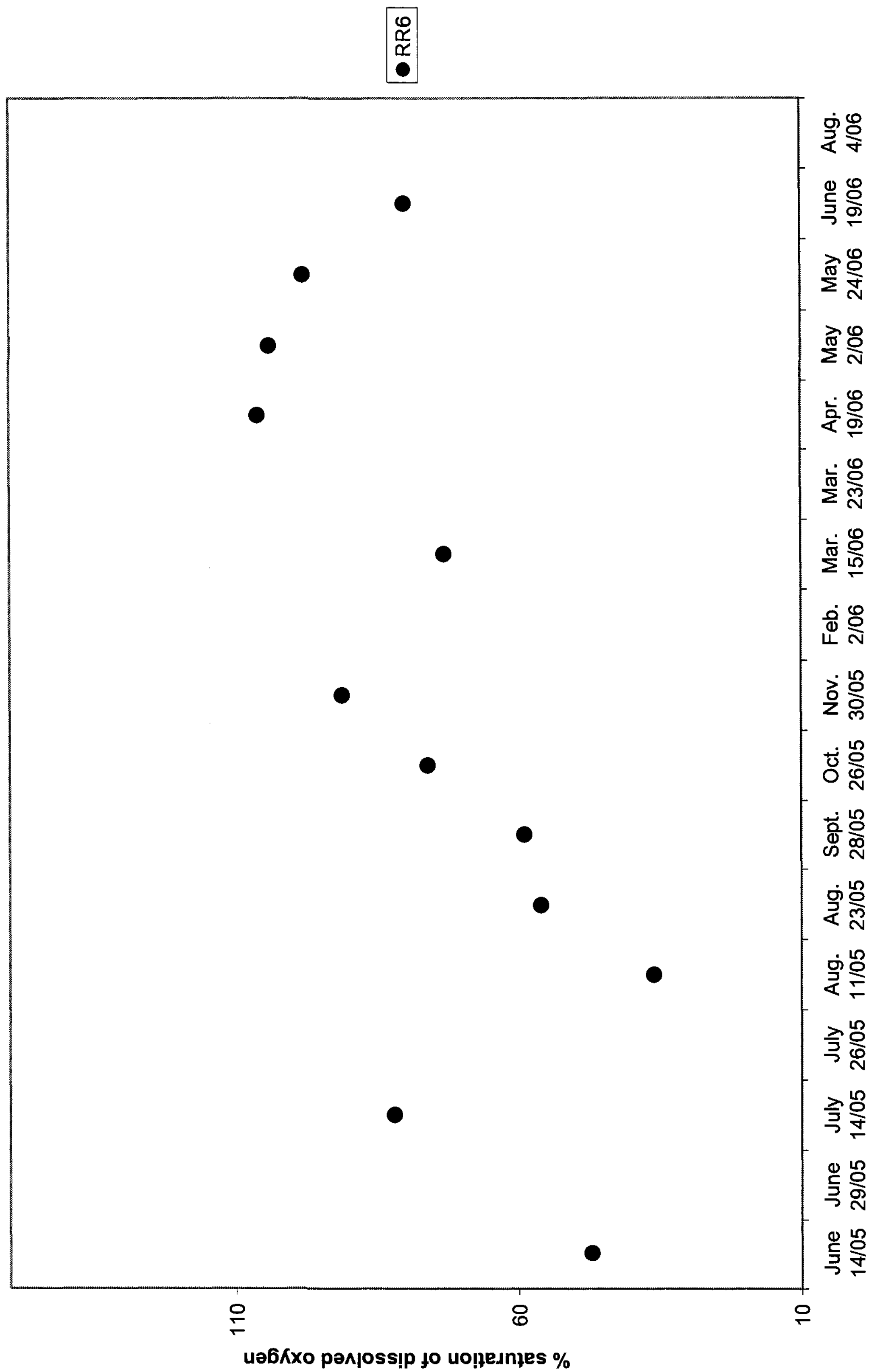
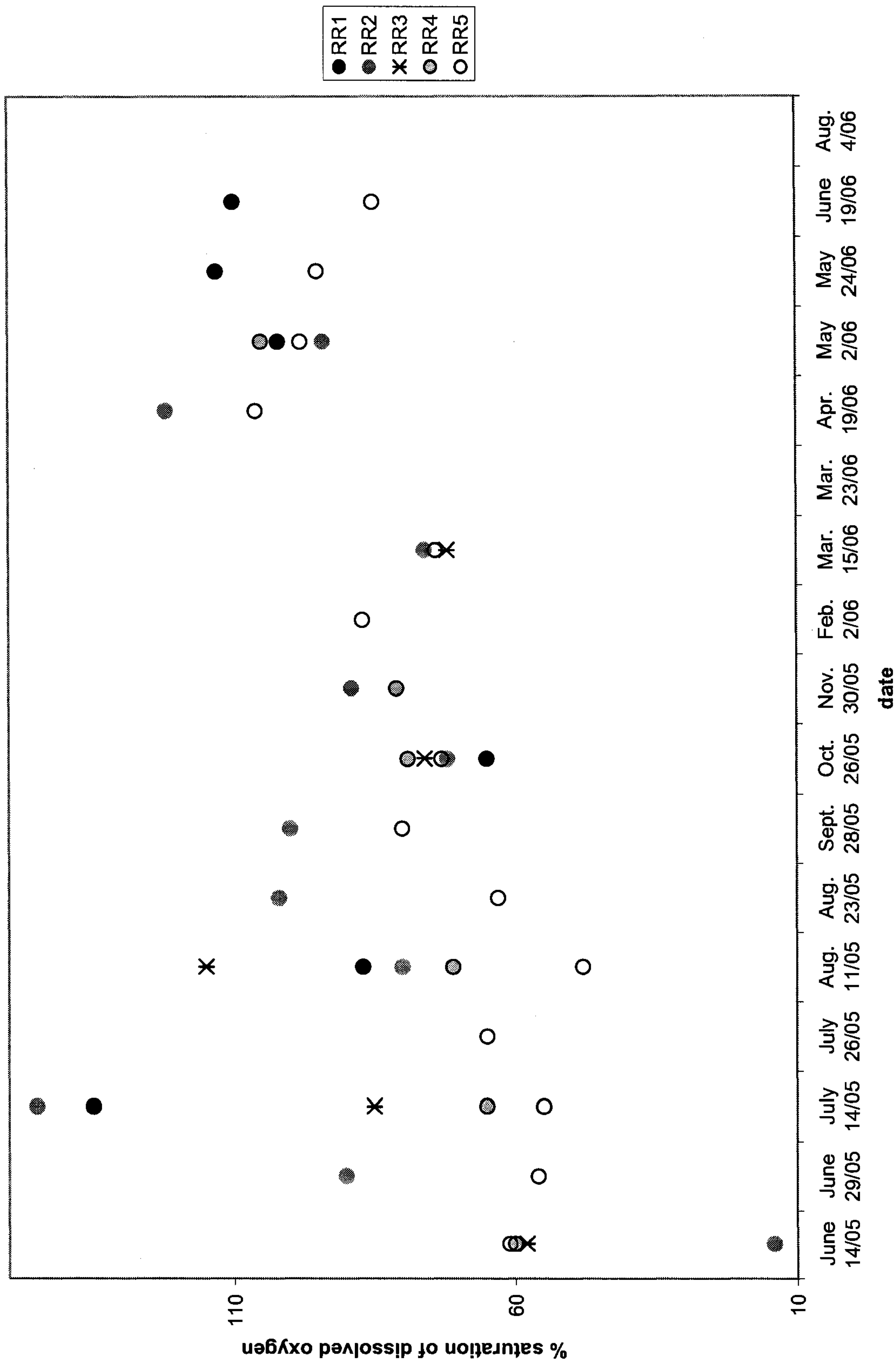

RR6
% saturation of dissolved oxygen
10
60
110
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

Figure 19E. Percentages of dissolved oxygen saturation for the South Division from June 2005 to 2006.


RR1
RR2
RR3
RR4
RR5
% saturation of dissolved oxygen
10
60
110
date
June 14/05
June 29/05
July 14/05
July 26/05
Aug. 11/05
Aug. 23/05
Sept. 28/05
Oct. 26/05
Nov. 30/05
Feb. 2/06
Mar. 15/06
Mar. 23/06
Apr. 19/06
May 2/06
May 24/06
June 19/06
Aug. 4/06

3.5 Overview of Mercury levels in the Peatland Sampling Sites

Sampling was carried out beyond the headwaters of the Raisin River to try to determine if wetlands were the significant source of methyl and total mercury into the watershed. At the same time, nutrients concentrations were also reported. Several sites were chosen: RR21, Newington Bog and Monkland Drain areas.

Figure 20A (page 187) shows data representative of MeHg concentration for all Peatland sites. Newington Bog A presented the highest MeHg levels at ~ 2.29 ng L^{-1} in May, while in the summer, the highest concentrations ranged from 0.9 to 1.13 ng L^{-1} when compared with all the peatland sites. As the fall season progressed, the MeHg concentrations generally seem to decrease overall. In contrast, Monkland Drain A presented slightly lower concentrations (0.1 to 0.44 ng L^{-1}) than RR21 (0.13 to 0.44 ng L^{-1}). The January sampling event demonstrated that Newington Bog B and Monkland Drain B yielded relatively similar MeHg concentration of ~ 0.5 ng L^{-1}, with Monkland Drain A having the lowest concentration (~ 0.2 ng L^{-1}). The MeHg concentrations tended to increase in the spring, however, this trend was not apparent for the Monkland Drain A which essentially remained constant (~0.2 to 0.24 ng L^{-1}).

Figure 20B (page 189) presents total mercury (THg) concentrations for the Peatland sites; however, the Monkland Drain A site (which was sampled on December 5, 2006 and yielded a THg concentration of 174.07 ng L^{-1}) appeared to be an outlier and was removed in an effort to identify trends. In general THg concentrations at Newington Bog ranged from 3.43 to 9.38 ng L^{-1}. During the spring months, March to May, the Newington Bog A showed a slight increase in THg concentrations (5.21 to 5.88 ng L^{-1}), while all other sites showed lower concentrations in the same period. Throughout the fall season, the THg concentrations appear to increase in the Newington Bog, with the exception of Newington Bog B, which peaked in November followed by a decline. As shown in Figure 20B (page 189), Monkland Drain B THg concentrations from November to December decreased (2.37 to 1.81 ng L^{-1}), while Monkland Drain and RR21 THg concentrations increased. In January, THg concentrations in Newington Bog B (5.04 ng L^{-1}) exceeded Newington Bog A (4.06 ng L^{-1}) and a similar observation is apparent for Monkland Drain B (1.36 ng L^{-1}) and Monkland Drain A (0.79 ng L^{-1}).

Figure 20C (page 191) shows data representative of the percentage of total mercury (THg) as methyl mercury (MeHg) for the Peatland sites. During the summer period, the percentage of THg as MeHg for the Newington Bog ranged from ~13% to 21 % and this exceeded the corresponding value (~8%) for the RR21 site. In contrast for July, the relative percentages for Monkland Drain A and Monkland Drain B were ~23 % and ~8 %, respectively. Overall for all sites sampled, the percentage of THg as MeHg appears to decrease from October to December. In January, corresponding percentages for the Monkland Drain ranged from ~25% to 36%, which exceeded those representative of the Newington Bog (9% to 21 %). During the spring (March to May) all sites showed an increase in percent; Monkland Drain ranged from 4.61% to 26 %, while Newington Bog ranged from 3.65% to 38.95%.

3.6 Overview of Nutrient levels in the Peatland Sampling Sites

3.6.1 Ammonia

Ammonia concentrations for all Peatland sites are shown in Figure 20D (page193). In June 2006, the NH_3 concentration levels (82-269 μg L^{-1}) for Newington Bog exceeded the level for RR21 (47 μg L^{-1}). Whereas in July 2006, Monkland Drain concentrations (3-29 μg L^{-1}) were lower than for RR21. In the fall, RR21 and Monkland Drain sites demonstrated the lowest concentrations of 0 and 74 μg L^{-1}, respectively. During the same period, Newington Bog A concentrations were in the range of 422-655 μg L^{-1} which is in very good agreement with the range levels (435-619 μg L^{-1}) observed for the Newington E site. In January 2007, Newington Bog A showed about 100 μg L^{-1} concentration increase overall. Later in the spring of 2007, Newington Bog A concentrations were in the range of 305 μg L^{-1} to 1079 μg L^{-1}, while for the remainder sites levels were relatively constant at about 40 μg L^{-1}. Overall for all seasons and for all sites taken collectively, Newington Bog demonstrated the highest concentrations.

3.6.2 Nitrate

Figure 20E (page 195) presents nitrate concentrations for all Peatland sites. Nitrate concentrations during the summer of 2006 and January 2007 were the lowest for all sites, where the values were in the range of 0 to 109 μg L^{-1}. Generally, Monkland Drain exhibited higher nitrate concentrations relative to Newington Bog. In particular, Newington Bog B yielded the highest nitrate concentrations (7 to 215 μg L^{-1}) relative to Newington Bog A (0 to 53 μg L^{-1}). In the fall season, RR21 nitrate concentration appeared to have peaked in November followed by a decline in December; while Monkland Drain A showed the highest nitrate concentration in December (~ 700 μg L^{-1}). In March, RR21 yielded the highest nitrate concentration (~650 μg L^{-1}), followed by Monkland Drain (~500 μg L^{-1}) and Newington Bog (~250 μg L^{-1}).

3.6.3 Sulphate

Sulphate concentrations are shown in Figure 20F (page 197) for the Peatland sampling sites. On average, Newington Bog concentrations were ~ 17 mg L^{-1} while for Monkland Drain the average concentration was ~ 10 mg L^{-1}. In the fall, RR21 concentrations tend to decline from 15 to 11 mg L^{-1}. Overall, it seems that for all sites the concentrations are relatively consistent for all seasons.

3.6.4 Total Phosphorus

Figure 20G (page 199) presents phosphorus concentration data for the Peatland sites sampled. RR21 presented the lowest concentration of total phosphorus (~ 10 μg L^{-1}) in June, while Monkland Drain B yielded the highest concentration of total phosphorus (~38 μg L^{-1}) in the summer. During the fall, Newington Bog and Monkland Drain A showed decreased concentrations from October to December. In December 2006, RR21 levels of total phosphorus increased from ~8 to ~43 μg L^{-1} with a similar trend observed for Monkland Drain B site. In January all sites yielded low concentrations (< 3 μg L^{-1}). For the spring, all sites except Newington Bog A decreased from March to May; the total phosphorus concentrations were < 23 μg L^{-1}.

3.6.5 DOC

Concentration data for DOC are shown in Figure 20H (page 201). RR21 concentrations are ~ 30 ppm for the summer and fall season and decreased to ~ 15 mg L^{-1} in the spring. A similar trend was observed for the Newington Bog site for which average concentrations were ~ 52 mg L^{-1}in the summer and fall season, and ~ 28 mg L^{-1} in the winter and spring seasons. Overall the Monkland Drain showed the lowest concentrations for all seasons; however, DOC concentrations appear to decrease from summer to fall, with a slight increase in the spring season.

3.6.6 DIC

Figure 20I (page 203) shows DIC concentration data for all the Peatland sites. In general Monkland Drain presented the highest DIC concentrations for all seasons; the average values were ~ 38 mg L^{-1}. In contrast, Newington Bog showed the lowest DIC levels averaging ~ 10 mg L^{-1}overall. RR21 averaged DIC concentrations were ~ 15 mg L^{-1} intermediary of Monkland Drain and Newington Bog sites. By way of trends, DIC concentrations appear to decrease in the fall and increase in the spring.

3.7 Overview of Statistically Significant Results in the Peatland Sampling Sites

3.7.1 Kruskal-Wallis Statistics

When the Kruskal-Wallis statistical method was applied to data collected from the Peatland sites, it was observed that in spite of differences noted amongst the sites for specific nutrients and for mercury, many of these differences were not statistically significant (Table 6, page 182).

Statistically significant spatial differences were determined for ammonia ($p= 0.020$), DIC ($p= 0.010$), pH ($p= 0.011$), and specific conductivity ($p= 0.007$) at the Newington Bog location. There was significant temporal finding for DOC concentrations at the Newington Bog location ($p= 0.019$). The Monkland Drain location only demonstrated spatial statistical findings for DIC (p= 0.038) and specific conductivity (p= 0.022). For RR21, since there was only the one sampling site at that location a Kruskal-Wallis statistical test could not be applied; hence, there were not any statistically significant temporal findings.

3.7.2 Spearman Correlation Analyses

Of the Spearman Correlations conducted for the Peatland sites only 8 deemed to be statistically significant (Table 7, page 184)). Newington Bog demonstrated significant correlations between methyl mercury and nitrate (negatively correlated with p= <0.001); total phosphorus (positively correlated with p= 0.005); temperature (positively correlated with p= <0.001); and dissolved oxygen (negatively correlated with p= 0.029).

For the Monkland Drain sampling area, significant correlations were identified: methyl mercury and pH (positive correlation with p= 0.015), methyl mercury and temperature (positively correlated with p= 0.028); THg and nitrate (positively correlated with p=0.039); and total mercury and DIC (negatively correlated with p= 0.044). RR21 demonstrated inconclusive findings for MeHg versus dissolved oxygen and for THg versus dissolved oxygen since the p value could be either significant or not.

Table 6. Summary results of Kruskal-Wallis statistical analyses applied to measured data, reflective of site and seasonal parameters for the Peatland sampling locations.

Material/ Properties	Parameter	Peatland Sampling Sites		
		Newington Bog	Monkland Drain	RR21[a]
Methyl Mercury	Sites	p= 0.572 n= 18[b]	p= 0.116 n= 13	
	Seasons	p= 0.225 n=18	p= 0.191 n= 13	p= 0.766 n= 5
Total Mercury	Sites	p= 0.649 n=18	p= 0.116 n= 13	
	Seasons	p= 0.639 n=18	p= 0.350 n= 13	p= 0.344 n= 5
% of Total as Methyl Hg	Sites	p= 0.452 n= 18	p= 0.775 n= 13	
	Seasons	p= 0.664 n= 18	p= 0.321 n= 13	p= 0.766 n= 5
Ammonia	Sites	p= 0.020 * n= 18	p= 0.830 n= 13	
	Seasons	p= 0.639 n= 18	p= 0.144 n= 13	p= 0.344 n= 5
Nitrate	Sites	p= 0.224 n= 18	p= 0.317 n= 13	
	Seasons	p= 0.206 n= 18	p= 0.785 n= 13	p= 0.202 n= 5
Total Phosphorus	Sites	p= 0.123 n= 18	p=0.943 n= 13	
	Seasons	p= 0.215 n= 18	p= 0.119 n= 13	p= 0.344 n= 5
Sulphate	Sites	p= 0.411 n= 18	p= 0.825 n= 13	
	Seasons	p= 0.864 n= 18	p= 0.381 n= 13	p= 0.264 n= 5
DOC	Sites	p= 0.334 n= 18	p= 0.719 n= 13	
	Seasons	p= 0.019 * n= 18	p= 0.117 n= 13	p= 0.325 n= 5
DIC	Sites	p= 0.010 * n= 18	p= 0.038 * n= 13	
	Seasons	p= 0.646 n= 18	p= 0.173 n= 13	p= 0.670 n= 5

Table 6 (con't). Summary results of Kruskal-Wallis statistical analyses applied to measured data, reflective of site and seasonal parameters for the Peatland sampling locations.

Material/ Properties	Parameter	Peatland Sampling Sites		
		Newington Bog	Monkland Drain	RR21[a]
pH	Sites	p= 0.011 * n= 18	p= 0.252 n= 13	
	Seasons	p= 0.411 n= 18	p= 0.077 n= 13	p= 0.202 n= 5
Specific Conductivity	Sites	p= 0.007 * n= 18	p= 0.022 * n= 13	
	Seasons	p= 0.733 n= 18	p= 0.281 n= 13	p= 0.755 n= 5
Dissolved Oxygen	Sites	p= 0.599 n= 15	p= 0.462 n= 11	
	Seasons	p= 0.060 n= 15	p= 0.400 n= 11	p= 0.259 n= 4

* Indicates statistically significant results, those that possess a p-value less than 0.05

[a]- Only seasonal analyses could be carried out for RR21 since only 1 site was present at that location.

[b]- **n** refers to the number of values utilized for each parameter and site.

Table 7. Summary results of Spearman correlation analyses applied to measured data reflective of mercury and nutrient interactions for the Peatland sampling sites.

Interaction	Peatland Sampling Sites		
	Newington Bog	Monkland Drain	RR21
MeHg vs. THg	r_s= -0.317[a] p= 0.200 n= 18[b]	r_s= 0.096 p= 0.755 n= 13	r_s= -0.500 p= >0.100 n=5
MeHg vs. Ammonia	r_s= 0.176 p= 0.488 n= 18	r_s= 0.551 p= 0.051 n= 13	r_s= -0.400 p=>0.100 n= 5
THg vs. Ammonia	r_s= -0.154 p= 0.544 n= 18	r_s= -0.501 p= 0.081 n= 13	r_s= 0.300 p=>0.100 n= 5
MeHg vs. Nitrate	r_s= -0.828 p=<0.001* n= 18	r_s= -0.415 p= 0.159 n= 13	r_s= -0.500 p=>0.100 n= 5
THg vs. Nitrate	r_s= 0.293 p= 0.240 n= 18	r_s= 0.577 p= 0.039* n= 13	r_s= 0.500 p=>0.100 n= 5
MeHg vs. Total P	r_s= 0.630 p= 0.005* n= 18	r_s= 0.035 p= 0.914 n= 13	r_s= -0.100 p=>0.100 n= 5
THg vs. Total P	r_s= -0.479 p= 0.045 n= 18	r_s= 0.274 p= 0.367 n= 13	r_s= -0.300 p=>0.100 n= 5
MeHg vs. Sulphate	r_s= 0.134 p= 0.600 n= 18	r_s= 0.217 p= 0.475 n= 13	r_s= 0.667 p=>0.100 n= 5
THg vs. Sulphate	r_s= 0.101 p= 0.694 n= 18	r_s= 0.184 p= 0.548 n= 13	r_s= -0.821 p=>0.100 n= 5
MeHg vs. DOC	r_s= 0.427 p= 0.077 n= 18	r_s= 0.490 p= 0.088 n= 13	r_s= 0.359 p=>0.100 n= 5
THg vs. DOC	r_s= -0.254 p= 0.309 n= 18	r_s= -0.097 p= 0.755 n= 13	r_s= -0.975 p=<0.1 but >0.050 n= 5
MeHg vs. DIC	r_s= 0.100 p= 0.694 n= 18	r_s= 0.033 p= 0.914 n= 13	r_s= 0.900 p=>0.100 n= 5

Table 7 (con't). Summary results of Spearman correlation analyses applied to measured data reflective of mercury and nutrient interactions for the Peatland sampling sites.

Interaction	Peatland Sampling Sites		
	Newington Bog	Monkland Drain	RR21
THg vs. DIC	r_s= -0.285 p= 0.251 n= 18	r_s= -0.564 p= 0.044* n= 13	r_s= -0.800 p=>0.100 n= 5
MeHg vs. pH	r_s= -0.024 p= 0.922 n= 18	r_s= 0.656 p= 0.015* n= 13	r_s= 0.600 p=>0.100 n= 5
THg vs. pH	r_s= -0.116 p= 0.645 n= 18	r_s= 0.470 p= 0.104 n= 13	r_s= 0.300 p=>0.100 n= 5
MeHg vs. Specific Conductivity	r_s= 0.103 p= 0.680 n= 18	r_s= -0.088 p= 0.777 n= 13	r_s= 0.975 p=<0.1 but >0.050 n= 5
THg vs. Specific Conductivity	r_s= -0.292 p= 0.240 n= 18	r_s= -0.544 p= 0.055 n= 13	r_s= -0.410 p=>0.100 n= 5
MeHg vs. Temperature	r_s= 0.870 p=<0.001* n= 18	r_s= 0.605 p= 0.028* n= 13	r_s= 0.600 p=>0.100 n= 5
THg vs. Temperature	r_s= -0.301 p= 0.226 n= 18	r_s= -0.131 p= 0.668 n= 13	r_s= -0.700 p=>0.100 n= 5
MeHg vs. dissolved Oxygen	r_s= -0.562 p= 0.029* n= 15	r_s= -0.330 p= 0.321 n= 11	r_s= -0.400 p=<0.010 or >0.100 n= 4
THg vs. dissolved Oxygen	r_s= 0.199 p= 0.478 n= 15	r_s= 0.201 p= 0.551 n= 11	r_s= 1.000 p=<0.010 or >0.100 n= 4

* Indicates statistically significant results, those that possess a p-value less than 0.05

[a]- $\mathbf{r_s}$ refers to the Spearman correlation coefficient (a positive value means the two parameters being tested are related in a positive way, whereas a negative value means that they are negatively related).

[b]- **n** refers to the number of pair values for each interaction for each site.

Figure 20A. Methyl mercury concentrations for Peatland sites from June 2006 to May 2007.

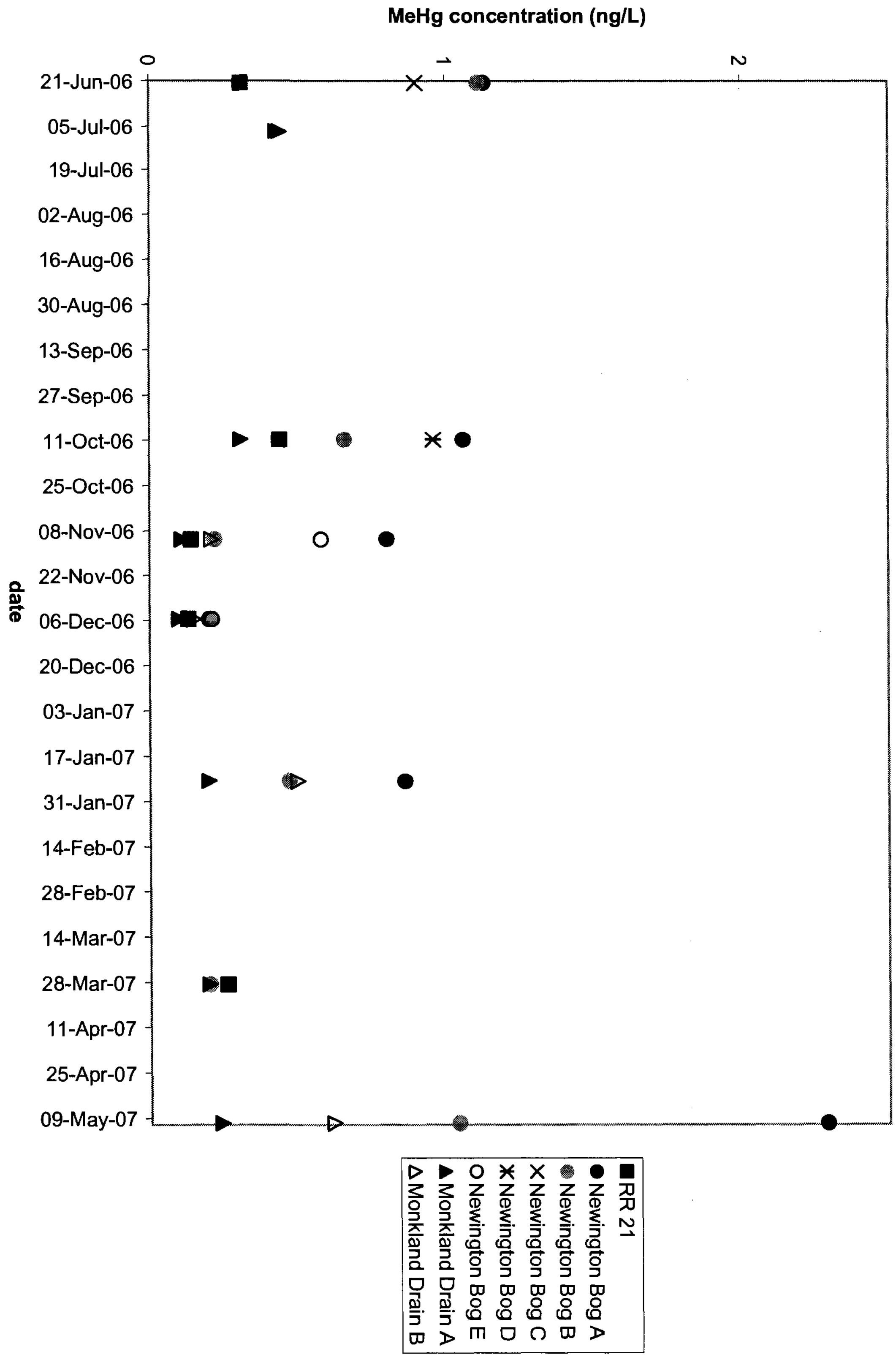
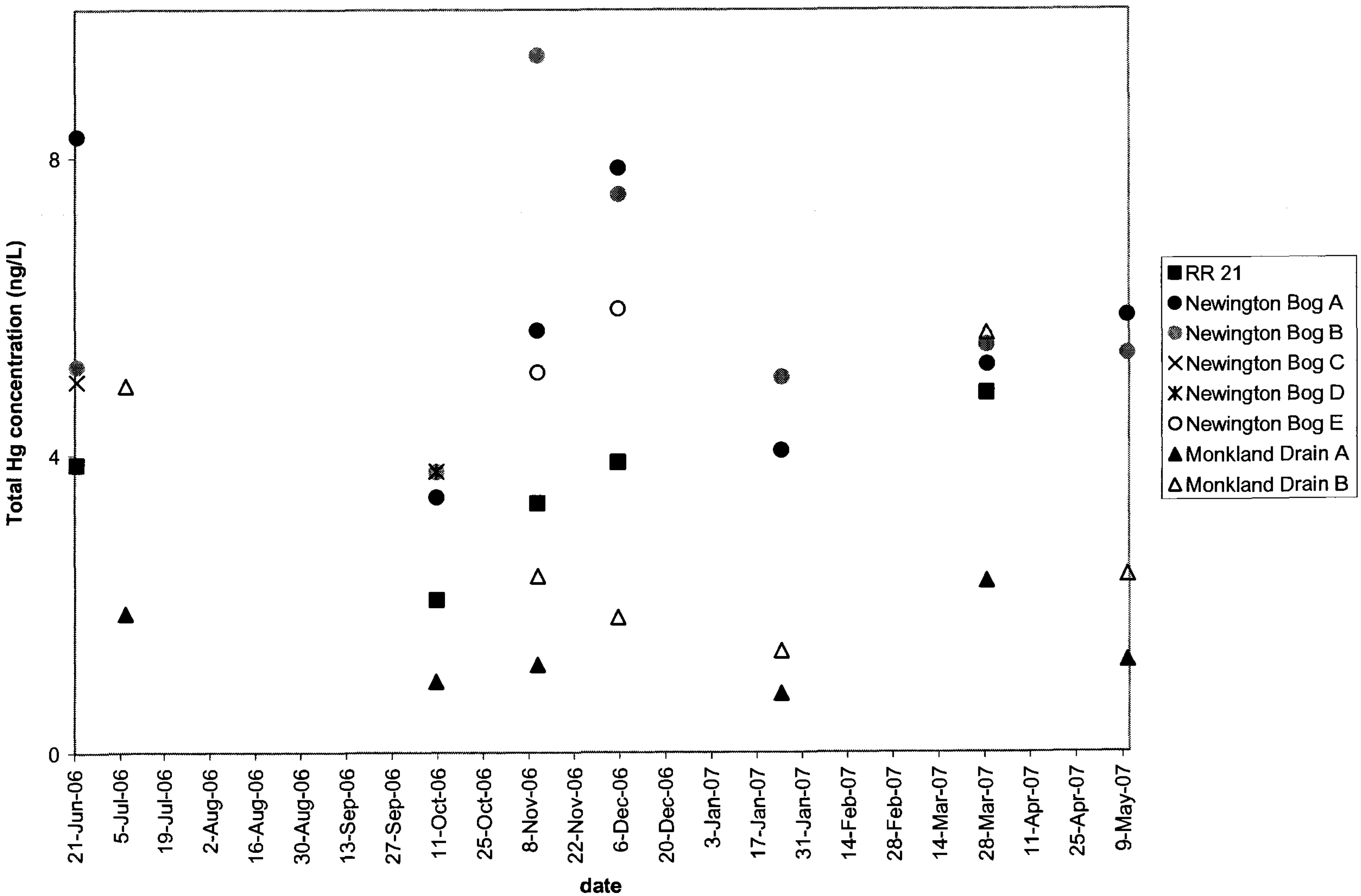

MeHg concentration (ng/L)
0
1
2
date
21-Jun-06
05-Jul-06
19-Jul-06
02-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
08-Nov-06
22-Nov-06
06-Dec-06
20-Dec-06
03-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
09-May-07
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20B. Total mercury concentrations for the Peatland sampling locations from June 2006 to May 2007. The THg concentration obtained for Monkland Drain A (174.07 ng L^{-1}) on December 5, 2006 was not included on this graph to better demonstrate possible trends.



Total Hg concentration (ng/L)
0
4
8
21-Jun-06
5-Jul-06
19-Jul-06
2-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
8-Nov-06
22-Nov-06
6-Dec-06
20-Dec-06
3-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
9-May-07
date
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20C. Percentage of total mercury as methyl mercury for the Peatland sites from June 2006 to May 2007.

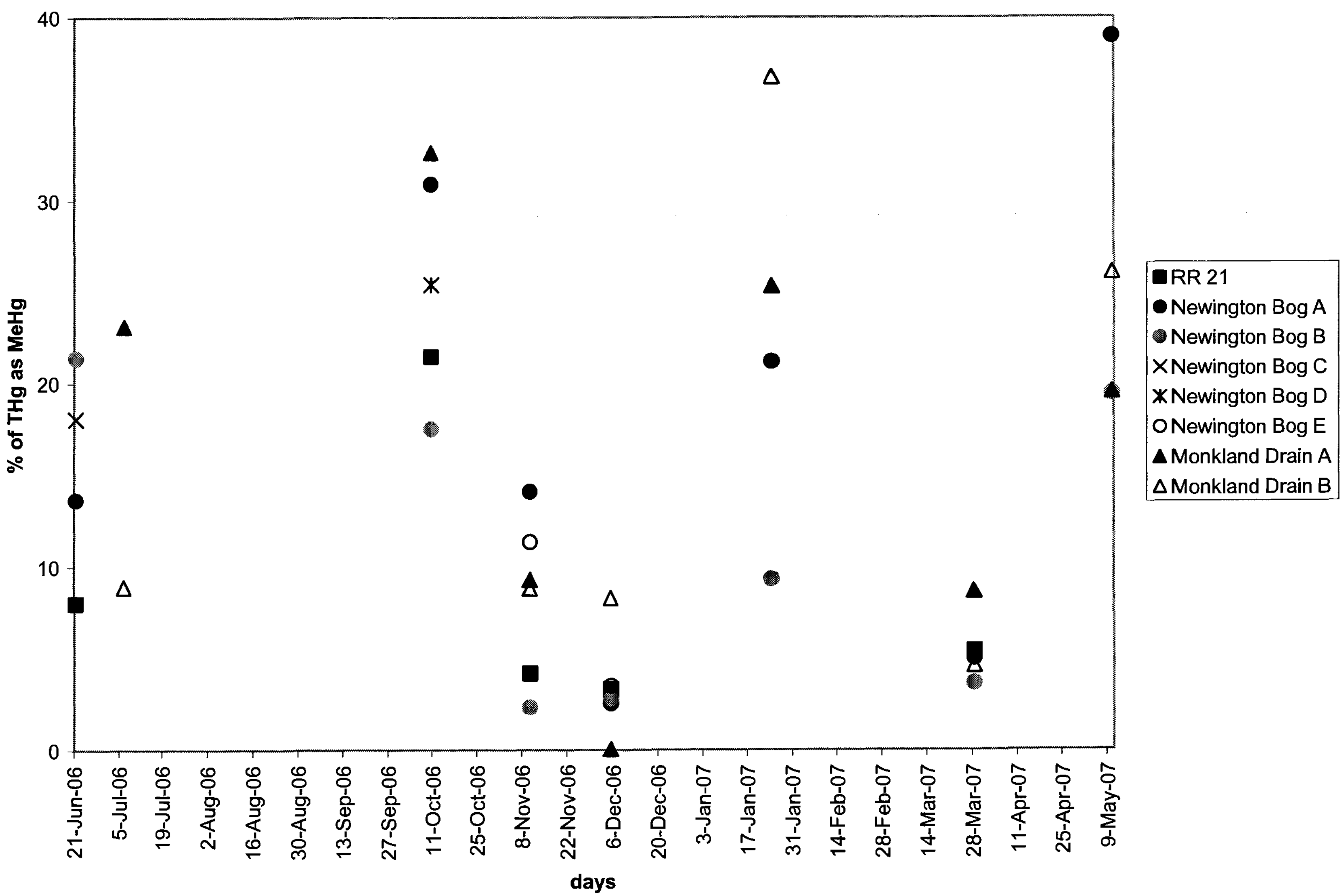
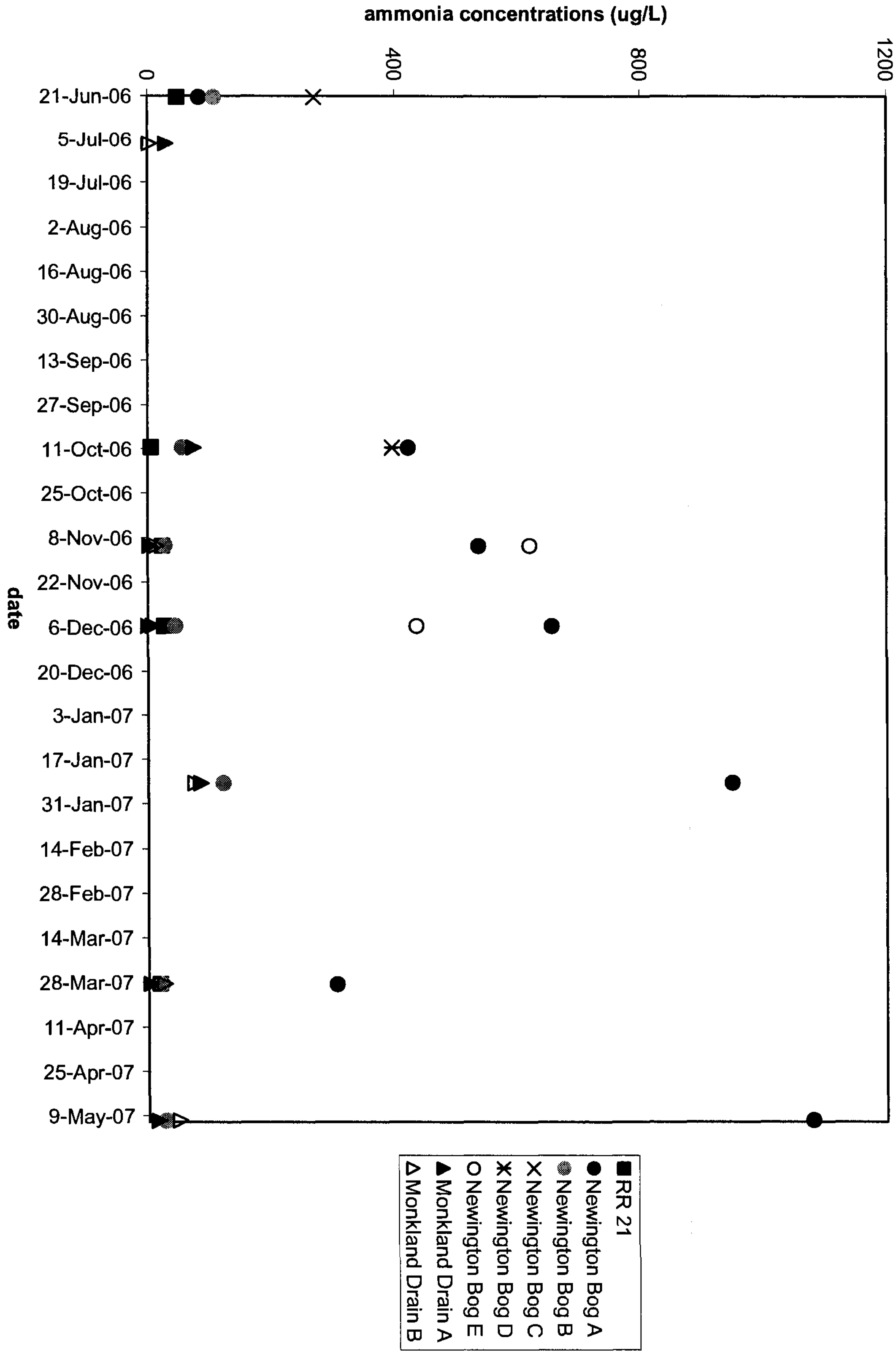
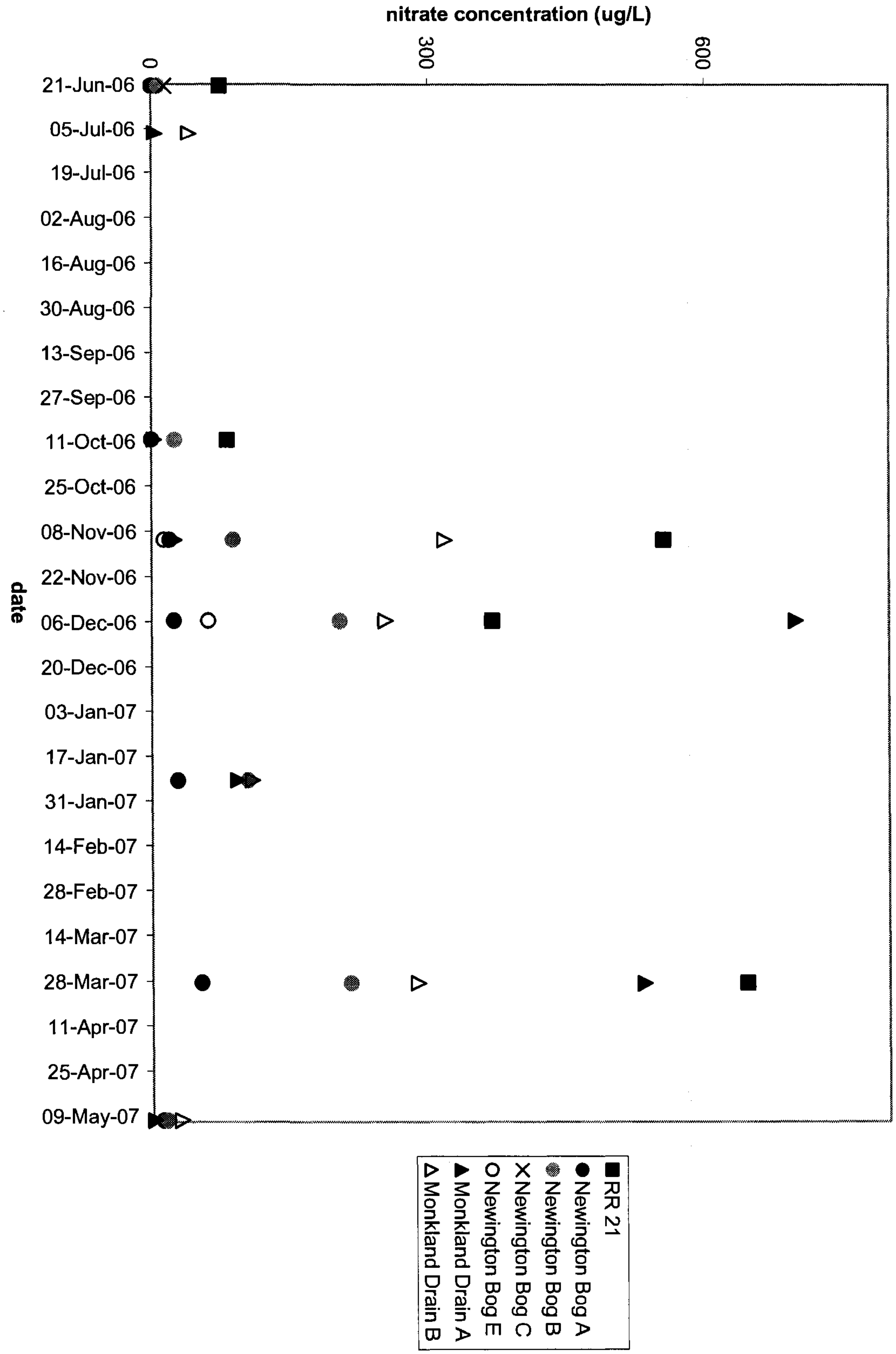

% of THg as MeHg
days
40
30
20
10
0
21-Jun-06
5-Jul-06
19-Jul-06
2-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
8-Nov-06
22-Nov-06
6-Dec-06
20-Dec-06
3-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
9-May-07
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20D. Ammonia concentrations for the Peatland sites from June 2006 to May 2007.



ammonia concentrations (ug/L)
0
400
800
1200
date
21-Jun-06
5-Jul-06
19-Jul-06
2-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
8-Nov-06
22-Nov-06
6-Dec-06
20-Dec-06
3-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
9-May-07
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20E. Nitrate concentrations for the Peatland sites from June 2006 to May 2007.



nitrate concentration (ug/L)
0
300
600
date
21-Jun-06
05-Jul-06
19-Jul-06
02-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
08-Nov-06
22-Nov-06
06-Dec-06
20-Dec-06
03-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
09-May-07
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20F. Sulphate concentrations for the Peatland sampling sites from June 2006 to May 2007.

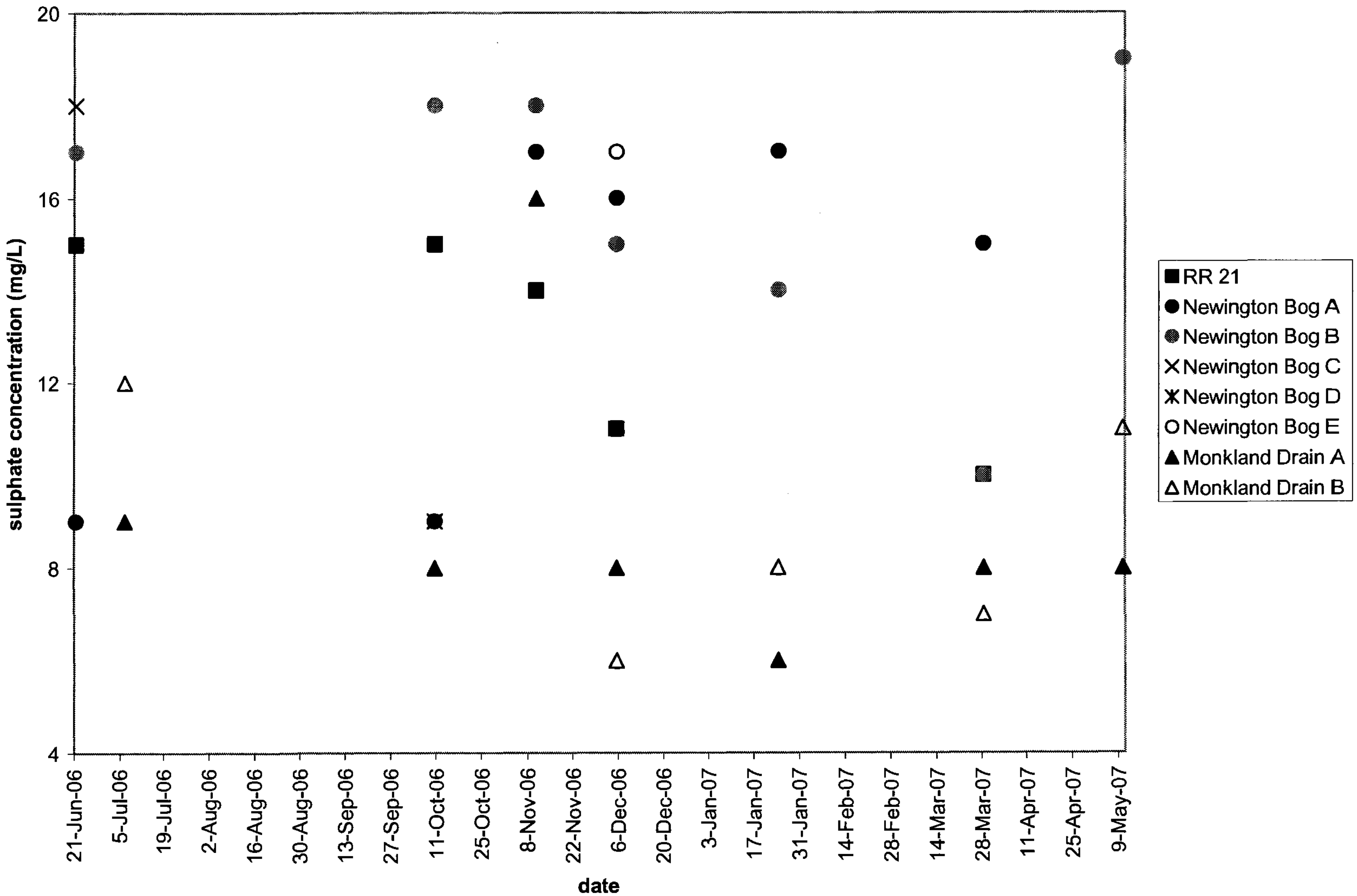
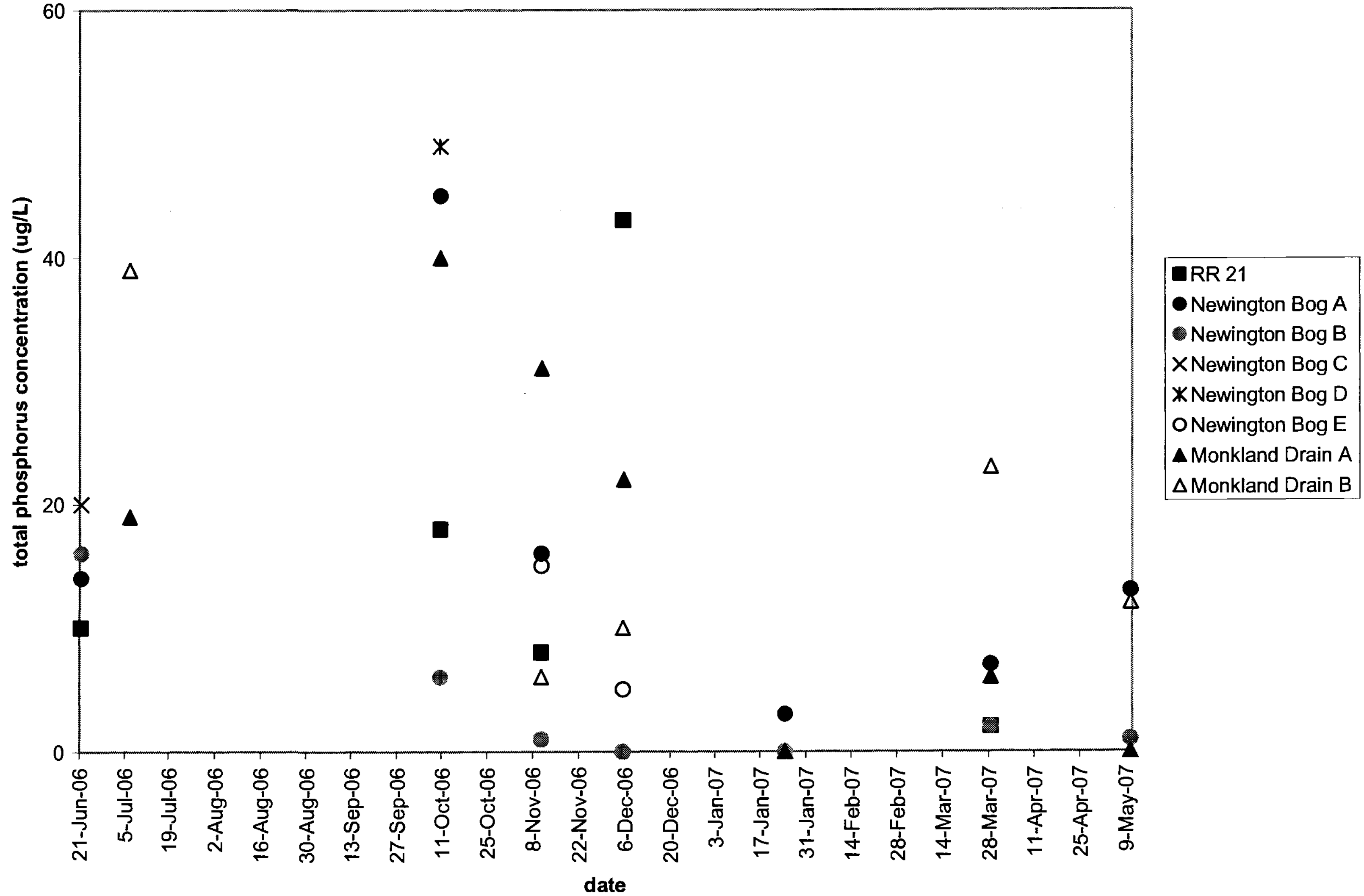

sulphate concentration (mg/L)
20
16
12
8
4
21-Jun-06
5-Jul-06
19-Jul-06
2-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
8-Nov-06
22-Nov-06
6-Dec-06
20-Dec-06
3-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
9-May-07
date
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20G. Total phosphorus concentrations for the Peatland sites from June 2006 to May 2007.



total phosphorus concentration (ug/L)
60
40
20
0
21-Jun-06
5-Jul-06
19-Jul-06
2-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
8-Nov-06
22-Nov-06
6-Dec-06
20-Dec-06
3-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
9-May-07
date
RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B

Figure 20H. Dissolved Organic Carbon concentrations for the Peatland sites from June 2006 to May 2007.

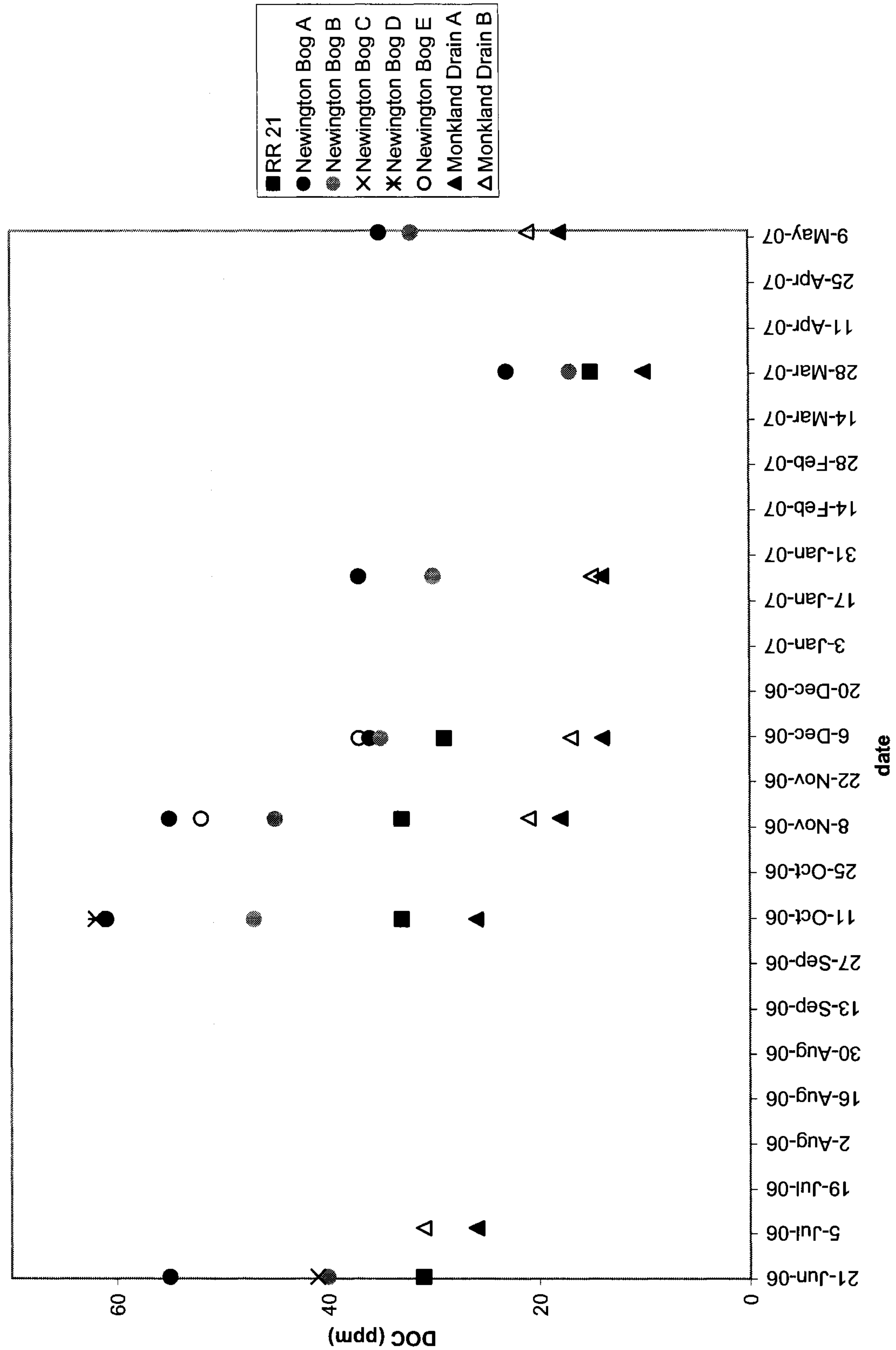
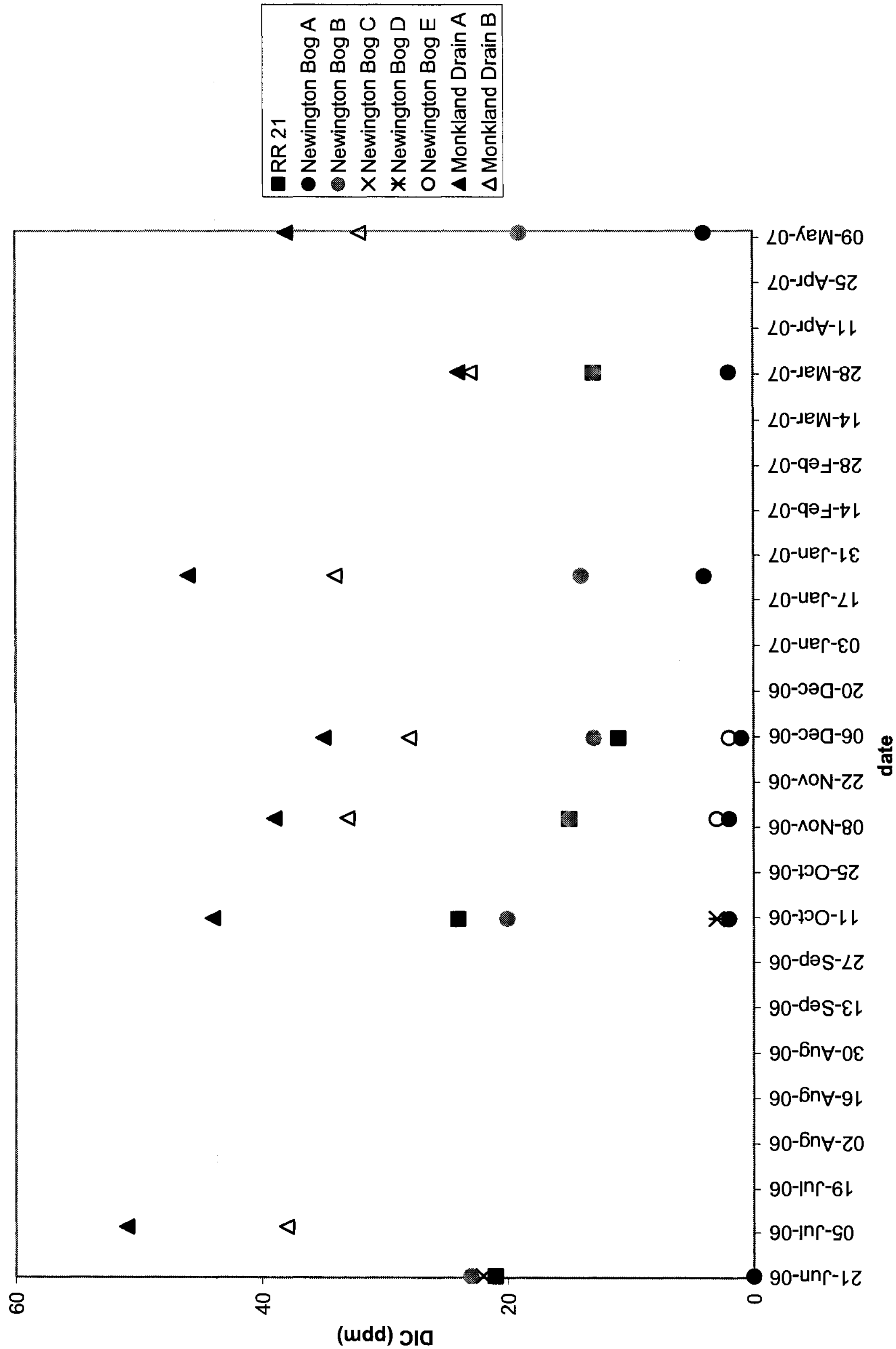

RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B
DOC (ppm)
0
20
40
60
date
21-Jun-06
5-Jul-06
19-Jul-06
2-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
8-Nov-06
22-Nov-06
6-Dec-06
20-Dec-06
3-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
9-May-07

Figure 20I. Dissolved Inorganic Carbon for the Peatland sampling sites June 2006 to May 2007.


RR 21
Newington Bog A
Newington Bog B
Newington Bog C
Newington Bog D
Newington Bog E
Monkland Drain A
Monkland Drain B
DIC (ppm)
0
20
40
60
date
21-Jun-06
05-Jul-06
19-Jul-06
02-Aug-06
16-Aug-06
30-Aug-06
13-Sep-06
27-Sep-06
11-Oct-06
25-Oct-06
08-Nov-06
22-Nov-06
06-Dec-06
20-Dec-06
03-Jan-07
17-Jan-07
31-Jan-07
14-Feb-07
28-Feb-07
14-Mar-07
28-Mar-07
11-Apr-07
25-Apr-07
09-May-07

4.0 DISCUSSION

Findings related to methyl mercury and total mercury in the 5 Divisions are discussed along with statistical analyses to identify seasonal and spatial variations. Nutrient correlations that showed statistical positive significance (Table 4, page 53) are discussed in conjunction with land use and agricultural activities. Comparisons with relevant studies were made, including inferences.

4.1 Methyl Mercury

Methyl mercury concentrations obtained in this river ranged from 0.03 to 1.02 ng L^{-1} for the 5 Divisions. Similar concentrations at the Peatland sites ranged from ~0.1 to 2.29 ng L^{-1}. This demonstrates that the Peatlands have higher concentrations of methyl mercury than the 5 Divisions, and clearly identifies this area as the source. These results are consistent with those reported in the literature: Babiarz *et al.*, 1998 reported that watershed concentrations for methyl mercury range from ~ 0.01 ng L^{-1} to 1.80 ng L^{-1} for watersheds sampled in Wisconsin, and noted that the higher concentrations occurred in areas associated with more wetland land-use. At the Roseau River, Minnesota, methyl mercury concentrations were greater than 1.4 ng L^{-1} (Balogh *et al.*, 2006). Loseto *et al.*, 2004 reported that wetlands in the Arctic demonstrated methyl mercury concentrations at the inflow of 0.02 ng L^{-1} where at the outflow concentrations averaged 1.21 ng L^{-1}.

The percentage of THg as MeHg in all 5 Divisions ranged from ~1.3 to 62.5 %, and in the case of Peatlands the range is ~0.06% to 31%. These values compare reasonably well with those reported in the literature. For example, Babiarz *et al.* (1998) demonstrated that throughout their study the percentage of THg as MeHg rarely exceeded 6% in 7 rivers (which exhibited both wetland and agricultural characteristics) in Wisconsin. Balogh *et al.* (2006) reported ~39 to 50% percentage of THg as MeHg for the Roseau River, Minnesota.

There is a seasonal variation of MeHg in the Raisin River. This is supported by Kruskal-Wallis statistical analyses (Table 3, page 51) for the North ($p=<0.001$), Main ($p=<0.001$), and South ($p=0.001$) Divisions. The North Division demonstrated highest MeHg concentrations in the summer (~0.22 to ~1.0 ng L^{-1}) and low concentrations in the winter (~0.18 to 0.22 ng L^{-1}) (Figure 6A, page 57). A similar pattern is clearly observed for the Main Division (summer range of ~0.26 to 0.86 ng L^{-1}, winter range of ~0.14 to 0.20 ng L^{-1}, Figure 7A, (page 63)) and the South Division (summer range of ~0.1 to 0.24 ng L^{-1}, and winter of 0.12 to 0.16 ng L^{-1}, Figure 10A, (page 81)). In the case of % of THg as MeHg, temporal patterns in all Divisions, except the Composite Division, were statistically significant (Table 3 (page 51), for North and Main $p = <0.001$, South $p= 0.001$, and North+Main $p=0.034$). These data appear credible and support a seasonal variation. An explanation may be advanced as follows. In the summer, warm temperatures create more potential sites for methylation to occur (i.e., at periphyton rich sites) thereby causing increased methylation (Guimaraes *et al.*, 2006). Additionally favorable conditions are achieved when summer aquatic plant growth is occurring due to reduction of available dissolved oxygen as seen in Figures 19A-D (pages 167-175). During the winter seasons, MeHg concentrations are expected to be low since cooler temperatures result in much less availably active bacteria for methylation of inorganic mercury (Choi *et al.*, 1994). It is worth noting that the graphical results in our study for the 5 Divisions (Figures 6A-10A, pages 57-81) do not show elevated (or spiked) MeHg increases for the spring season. This can be explained as follows. In principle, yield is directly proportional to the product of concentration and flow and inversely to the surface area, thus, in the spring both the concentration (due to spring runoff) and the resultant increased flow would increase the yield, but these episodes were probably missed at the time samplings were conducted. However, there is evidence that suggests the spring freshet (first thawing of winter snow) can result in MeHg releases from contaminated snow into nearby water systems (Gustin *et al.*, 2006). Merging of the separate Divisions results in higher flow rates, which effectively dilute preexisting concentrations as previously described. Other effects can coexist, for example, variations of reversible demethylation and methyl mercury uptake mechanisms that mask spring increases.

In contrast, the North+Main and Composite Divisions do not demonstrate any statistically significant seasonal variations (p=0.079, p=0.287, respectively Table 3 (page 51)). Also there are no apparent statistical seasonal variations demonstrated for the Peatland sites (Table 6, page 182). Several explanations are plausible. (1) Relative location of the branches and dilution effect. The merging of the North and Main Branches ~27 km downstream (from RR19 on the Main Division) increases the volume of water, but not the flow rate, since the width was apparently wider in the North+ Main Division. A similar argument can be made for the Composite Division (formed as the South and North+Main Divisions merge). Volumetric increases in water invariably induces much mixing which effectively dilute any contaminants that might be present, a mechanism that supports the low MeHg concentrations observed. (2) Low inputs of mercury. In spite of the increased surface areas in these locations the overall inputs of mercury are probably low and therefore insufficient to demonstrate a seasonal variability. (3) Sampling sensitivity. There might have been an intrinsic bias associated with the sampling times and collected samples. At the time samples were collected low concentrations might already exist in the water system as opposed to sometime later (or sooner) when there were higher mercury inputs (e.g, land/surface runoffs) which are probably more reflective of the water system; this type of affect is akin to a 'hit and miss' sampling situation, but episodes (e.g., rainfall, sudden discharge of effluents, etc.) that promote runoff or increased loading could not be determined a priori in order to be monitored and properly accounted for in this work. In spite of this limitation, the results reported in this work are representative of the conditions at the time of samplings and would seem realistic. (4) Demethylation effects. In spite of significant levels of MeHg, demeythlation rates are high to obscure any variations suggestive of a seasonal effect.

Kruskal- Wallis analyses (Table 3) do not reveal statistically significant differences among the various sites representative of the 5 Divisions of the Raisin River that are suggestive of a spatial trend for MeHg and for % of THg as MeHg. No spatial differences are apparent for the Peatland sites based on Krusal-Wallis analyses (Table 6, page 182).

Average yield calculations for MeHg demonstrate a decrease from upstream to downstream (Table 5, page 55), which is also observed in the net yield calculations (Tables 1A-5A, Appendix B, page 230). This supports the hypothesis that Peatlands are the most likely source of MeHg into the river. High concentrations from methylation processes upstream in combination with increased runoff and flow will lead to dilution effects downstream; hence, concentrations overall would decrease downstream. An opposite effect (low concentration upstream (RR21) versus high concentration downstream (RR19) observed in the Main Division, may be explained as increased methylation, or less biotic uptake (few vegetation and aquatic bioorganisms present) occurring at the downstream site.

Additionally loadings and runoff from industrial or agricultural activities are sources that would increase MeHg at RR19.

MeHg production increases when peatlands are drained (Westling, 1991). This is demonstrated in the case of the Newington Bog A, where in January water levels were observed to be low, a condition that persisted until May 2007 when samples collected yielded the highest MeHg among all sites (Figure 20A, page 187). Water level seems to have a larger impact on MeHg concentrations than seasonal variations.

4.2 Total Mercury

Total mercury concentrations obtained in this study vary from 0 to 7.57 ng L^{-1} for the 5 Divisions and from 0.79 to 174 ng L^{-1} for the Peatland sites. It has been demonstrated in other studies that for total mercury, unfiltered samples, the concentrations ranged from 0.3 to 45.9 ng L^{-1} with a mean of 4.74 ng L^{-1} (Babiarz *et al.*, 1998). Total mercury concentrations from the study conducted by Hurley *et al.*, 1995 involving Wisconsin rivers, were found to be ~3.46 ng L^{-1}.

Temporal trends were statistically significant in the Main (p= 0.021) and South (p= <0.001) Divisions, based on Kruskal-Wallis analyses (Table 3, page 51). In contrast, Peatlands did not show any temporal significances (Table 7, page 184). The Main Division demonstrated THg concentrations during the summer (from ~0.15 to 5.25 ng L^{-1}) and winter (~2.0 to 3.5 ng L^{-1}) (Figure 7B, page 65). Differences in summer and winter sampling events were also apparent for the South Division, which showed THg concentrations in the summer (from ~1 to 3.65 ng L^{-1}) and late winter (from ~1.1 to 3.0 ng L^{-1}). High THg concentration could be explained as follows: (1) Rates of demethylation exceed rates of methylation resulting in an increased of inorganic Hg in the water column. (2) Inorganic mercury leaching from the sediments into the water column. (3) Presence of other species and particulates of mercury.

Kruskal-Wallis analyses (Table 3, page 51) do not reveal statistically significant differences among the various sites representative of the 5 Divisions of the Raisin River that are suggestive of spatial differences for THg. No spatial differences are apparent for the Peatland sites based on Krusal-Wallis analyses (Table 7, page 184).

Average yield calculations for THg in the North, North + Main Divisions demonstrate a decrease from upstream to downstream (Tables 1B and 3B, respectively, pages 230 and 245). This supports the hypothesis that Peatlands are the most likely source of THg into the river. Furthermore, the North Division which is nearest the Monkland Drain (Peatland) demonstrated consistently high THg yields within that Division, a result that corroborates well with the ecological finding that peatlands of even a few meters depth represent a long history of build up that spans thousands of years of atmospheric mercury deposition (Koenig, 1999) with alteration this mercury becomes mobilized, hence high yield. The South Division demonstrated decreased yields downstream, however, there was an elevated value at site RR3 (Table 5B, page 255). Certain factors may be responsible for the elevated concentrations observed: (1) potentially there are other mercury species present, perhaps in particulate form caused by increased runoff; (2) dead plant biomass which could contain mercury; and (3) demethylation rates which are accelerated at that location. Urban sources may contribute to THg yields at RR3.

4.3 Nutrients

In this part, the focus is on those pollutants and nutrients that are significantly positive (i.e., for p values < 0.05, meaning that when a pollutant is plotted against a nutrient and vice versa, a linear relationship results) as determined by Spearman statistics (Table 4, page 53). Each Division would be considered since data is site specific.

In the North Division (RR22 (upstream), RR20, RR16 (downstream)), MeHg vs THg, MeHg vs ammonia, and MeHg vs TP were positively correlated and are of interest. Because average yields implicitly incorporated all areas upstream, it is necessary to determine the relative contribution between upstream and downstream sites (these values are reflected as the last entries (Net Yield) in Tables 1-5 in Appendix B, pages 230-259). In the case of MeHg, a comparison of the average yields for the 3 sites (Table 1A, page 230) shows a generally decreasing trend, one that is highly suggestive of an upstream source either at site RR22 or at a site further upstream. As seen in Table 5 (page 55), RR22 demonstrates the highest MeHg yield, meaning that it originated from the Peatland upstream. On the other hand should a downstream site show an elevated yield (greater than an upstream site), this would imply a localized effect (e.g., increased input source or methylation) is occurring at that site. Within these contexts, sites RR20 and RR16 gave a negative net yield, which means that the upstream source remains dominant as previously discussed, but site RR16 showed a slightly higher yield than its upstream neighbor (RR20), and this suggests a relatively small localized effect is present. Consideration of the land features (Table 2, page 24) revealed that RR16 has more cropland in its immediate vicinity compared to the upstream sites (RR22 and RR20), thereby, implicating increased nutrients inputs from agricultural activities. Though increased microbial growth with temperature can account for high MeHg concentrations, the data obtained in this study reflect sample times that span several months (June 2005 to May 2006) with wide fluctuations in temperature and this precludes any direct association of a temperature effect occurring at RR16. In the case of THg, RR16 demonstrated a lower net yield relative to RR22. For this two possibilities exist (i)THg is diluted downstream, and (ii) the source originates further upstream of RR22 and the Monkland Drain Peatland region. For total phosphorus and ammonia, RR16 showed a higher net yield relative to RR20, even though both contributed negatively overall. RR16, being situated predominantly near cropland, possibly incurred increased run-off from fertilization activities, influenced by possible synergism which cannot be determined from this study.

Similarly in the Main Division, 5 pollutant-nutrient pairs are of interest (MeHg vs THg, MeHg vs Ammonia, THg vs ammonia, THg vs nitrate, and MeHg vs TP) at the 5 sites (RR21 (upstream), RR19, RR18, RR17, RR15 (downstream)). In the case of MeHg, THg, and TP, there was a positive net yield at RR19, however, all remaining sites downstream showed negative yields. Site RR15 showed a slightly higher yield than RR17 for MeHg, THg, and nitrate; RR15 is situated downstream of Martintown, and is near ~70% cropland. For total phosphorus a similar yield occurred at RR17, which is situated near abandon fields and downstream of St. Andrews. As seen in Table 5 (page 55), RR19 yields are consistently high for MeHg, THg, Total phosphorous, nitrate and DOC. RR19 is fed from runoff from nearby abandon fields/pastures and settled /developed land. Overall localized effects are implicated in the observed perturbations. In contrast for ammonia all sites produced negative net yields with a localized effect occurring at RR17; increased decomposition and decreased nitrification are suggestive of the latter effect.

For the North + Main Division, MeHg vs THg and MeHg vs TP are of interest at 3 sites (RR13(upstream), RR12, RR7 (downstream)). For MeHg, upstream sites showed negative net yields, except at RR7 due to localized effects as previously described, based on RR7 being near abandon fields/pastures and being downstream from Williamstown. For all sites, the net yields for TP and THg were negative.

In the South Division, MeHg vs THg, MeHg vs ammonia, THg vs ammonia, MeHg vs nitrate, THg vs nitrate, MeHg vs TP, and THg vs TP at 5 sites (RR1 (upstream), RR2, RR3, RR4, RR5 (downstream)) are of interest. For MeHg all sites showed negative net yields; RR3 exhibited a localized effect which is implicated by two factors, (i) increase in cropland with corresponding agricultural activities, and (ii) location downstream of Cornwall where runoff from residential/community activities are most likely to occur. Also, a localized effect occurred at the most downstream site (RR5) which is situated by surrounding cropland and its associated runoff, abandoned fields/and pastures, and partly sparse deciduous forest which may contribute to increased levels of MeHg from foliage and debris high in mercury. Similarly, total mercury net yields were all negative with a localized effect at RR5 (the most downstream site). For nitrate, net yields were negative at RR2 and RR5 and positive at RR3 and RR4; the latter finding suggests a localized effect. Further examination of the ambient land features at RR3 revealed mixed forest, ~30% cropland and some settled and developed lands; thus, it is plausible that runoff from fertilizer and other agricultural inputs can increase the nitrate concentrations at RR3 and RR4. The net yield for total phosphorus occurred at RR4 and is attributed to runoff associated with fertilizer, livestock and cropland. In the South Division, the net yields for ammonia were negative indicating no specific site of contribution, but suggest either biological uptake or nitrification in the river system since the nitrate net yields were positive at the downstream sites (RR3, RR4).

As seen in Table 5, RR1demonstrated high MeHg levels comparable to those at RR19, RR21 and RR22. The latter 3 sites are near Peatland, and RR1 is not. Thus, a localized effect is implicated. Examination of the land use features (Table 2, page 24) reveals that the majority of the land in that area is forest, and the tree leaves and foliage on the forest bed are MeHg sources (Smith, 1972). In addition, there is upstream (~ 2 km) developed/settled land comprising commercial areas (shopping plaza and residents) and this could potentially be a MeHg source. Input from the St. Lawrence River is unlikely to be a source, since typically its levels are low (Lean, 2000) and could not cause the relatively high levels seen at RR1.

Collectively, considerations of the yield data in this study in combination with land features suggest that (i) cropland mass and associated agricultural activities and (ii) runoff and input from residential/community activities in upstream towns can influence nutrients and pollutant levels in water systems.

5. CONCLUSIONS

Concentration data representative of MeHg and THg in the 5 Divisions that comprise the Raisin River are presented and reported; they compare very well with those reported in the literature for aquatic systems elsewhere. Variances are expected based on the hydrological and geophysical properties therein. Seasonal variations were identified for the South, Main and the North Divisions for MeHg, based on Kruskal-Wallis statistical analyses. Seasonal variations were similarly identified in the Main and South Divisions for THg. No significant spatial findings for MeHg and THg were revealed. For MeHg and THg, there were no significant seasonal or spatial patterns observed in the Newington Bog and Monkland Drain.

Spearman statistical analyses revealed some significantly positive correlations of MeHg and THg with nutrients and these are presented in this study (Tables 4 and 7, pages 53 and 184). A single nutrient is not solely responsible for mercury methylation. Furthermore, it is difficult to identify a relationship between any single nutrient measured level and the predicted MeHg or THg levels; other factors and synergistic effects seem likely to influence such predictions, but they cannot be identified from this work.

Newington Bog demonstrated the highest concentrations of MeHg when water levels were the lowest within the peatland. This implies that methyl mercury inputs into the Raisin River originate from peatlands which have been altered and drained. The draining and creation of trenches within the peatlands causes the pH to become neutral, which results in an optimal growing environment for sulphate-reducing bacteria to flourish and methylate mercury. The MeHg produced in the peatland vicinity leaches into the Raisin River.

Yields generally decreased from upstream to downstream sites. Few downstream sites exhibited increased yields. Collectively, considerations of the yield data in this study in combination with land features suggest that (i) cropland mass and associated agricultural activities, and (ii) runoff and inputs from residential/community activities in upstream towns can influence nutrients and pollutant levels in water systems. These factors can be used advantageously to manage nutrient and mercury levels in water systems and at specific sites that show positive net yields. In addition, the restoration of the Newington Bog and Monkland Drain areas to water levels that exist prior to drainage would cause the neutral pH to decrease to acidic levels over some period of time which ultimately would cause mercury methylation to decline thereby decreasing Hg inputs into existing water systems.

While the findings in this study are useful, improved knowledge in certain areas would seem helpful. Detailed monitoring of the peatland itself to better track and determine if, when and where Hg and nutrient levels peak is suggested so as to gain a better understanding of seasonal variations and extreme weather events (e.g., rainfall). A manipulation experiment involving the restoration of a peatland area that could identify the approximate time for acidic conditions to resume and also monitor ecosystem and vegetation changes is suggested. A study of the horizontal migration of Hg or THg from peatland soil into the Raisin River as a function of depth (at the River/ peatland interface) would help improve our knowledge of natural inputs into aquatic systems in the spring, summer and fall seasons. A laboratory experiment in which a core section of peatland is acquired and water is allowed to filter through the peat and the filtrate is collected at regular intervals and analyzed for MeHg. An empirical relationship between any single nutrient measured level in surface water of wetlands and the predicted MeHg or THg levels that can leach into the River system would help predict inputs.

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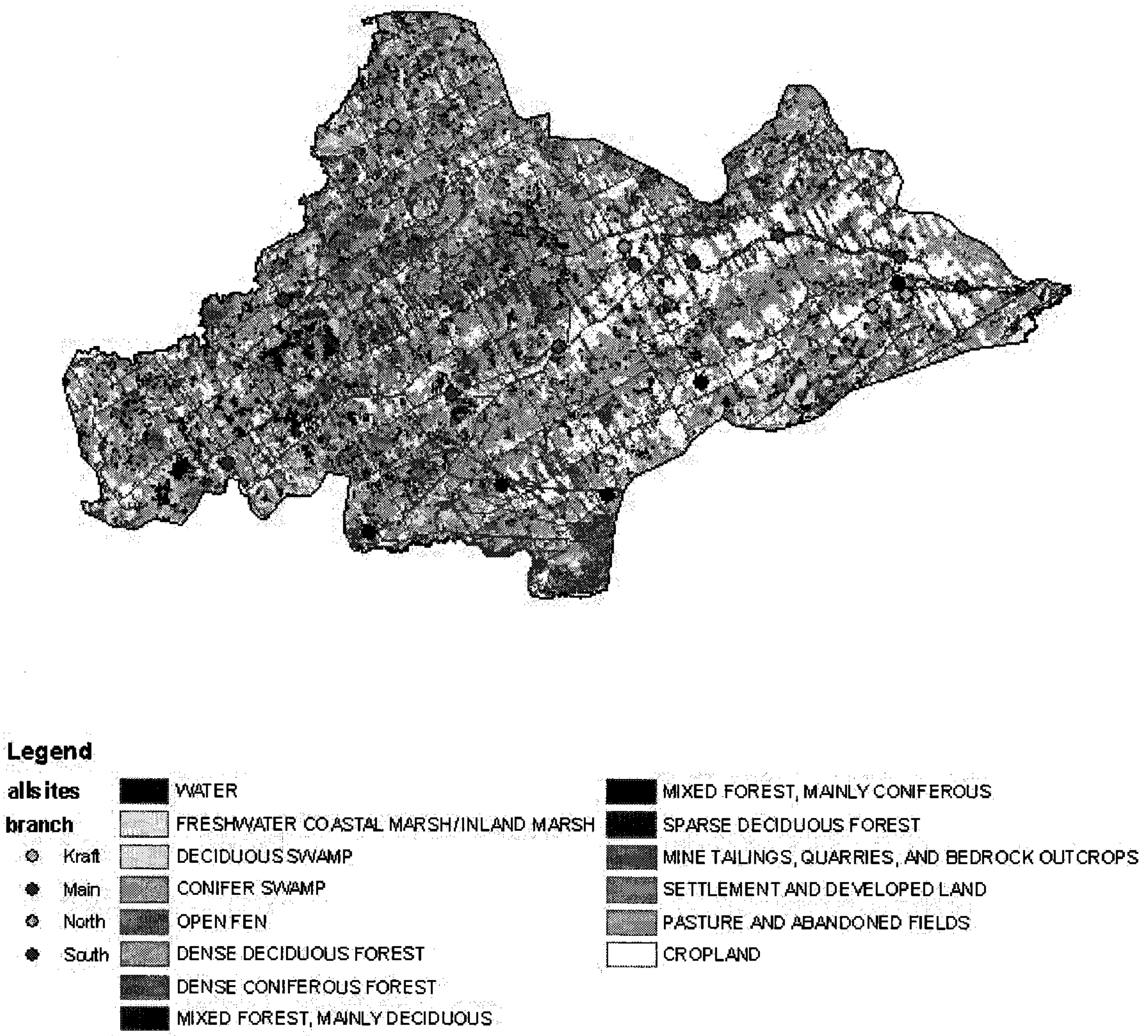
7. APPENDICES

7.1 APPENDIX A

Figure 1. The data map was obtained from the Ontario Ministry of Natural Resources where each pixel square represented 25 m by 25m of ground area. Descriptions for landuse at each site is summarized in Table 2.



South Branch Annual Flow Patterns

The following tables demonstrate the daily flow ratios of measurements obtained at the Long Sault Water Survey of Canada (WSC) monitoring station, which was located upstream along the South Division, relative to flows measured at the Williamstown WSC station (situated near to RR12).

Daily Ratios for 1996:

July	August	September
0.011	0.008	0.377
0.036	0.004	0.328
0.059	0.006	0.303
0.056	0.009	0.424
0.068	0.011	0.456
0.092	0.01	0.413
0.12	0.012	0.207
0.142	0.014	0.188
0.163	0.017	0.251
0.183	0.021	0.446
0.15	0.024	0.434
0.085	0.029	0.218
0.043	0.037	0.088
0.047	0.036	0.044
0.03	0.039	0.036
0.01	0.063	0.026
0.015	0.018	0.008
0.022	0.019	0.008
0.032	0.03	0.012
0.046	0.041	0.025
0.0601	0.05	
0.105	0.065	
0.142	0.076	
0.183	0.088	
0.213	0.115	
0.252	0.147	
0.213	0.188	
	0.16	
	0.153	
	0.2	
	0.342	

Ratio average for 1996:
0.114129

Daily Ratios for 1995:

July	August
0.595	0.416
1.193	0.554
1.287	0.667
1.437	0.161
1.198	0.132
0.748	0.04
0.78	0.03
0.876	0.044
0.874	0.069
0.953	0.053
0.344	0.073
0.159	0.113
0.229	0.101
	0.103
	0.125
	0.177
	0.233
	0.187
	0.158
	0.153
	0.201
	0.228
	0.253
	0.289
	0.35
	0.411
	0.442
	0.412
	0.5
	0.429

Ratio average for 1995:
0.413419

Daily Ratios for 1994:

August	September
0.457	0.617
0.839	0.441
0.935	0.356
1.058	0.415
1.245	0.493
1.424	0.574
1.575	0.681
1.784	0.349
1.381	
1.492	
1.615	
1.889	
2.073	
1.162	
0.93	
0.835	
0.942	
0.986	
0.88	
0.66	
0.646	
0.797	
1.019	
0.867	

Ratio average for 1994:
0.981781

South Branch Annual Flow Patterns-continued

The following tables demonstrate the daily flow ratios of measurements obtained at the Long Sault Water Survey of Canada (WSC) monitoring station, which was located upstream along the South Division, relative to flows measured at the Williamstown WSC station (situated near to RR12).

Daily Ratios for 1993:

July	August	September
0.227	0.42	0.276
0.326	0.409	0.227
0.279	0.508	0.23
0.257	0.571	0.172
0.48	0.577	0.061
0.626	0.602	0.039
0.562	0.611	0.048
0.461	0.619	0.033
0.462	0.656	
0.422	0.551	
	0.322	
	0.306	
	0.318	
	0.371	
	0.403	
	0.418	
	0.425	
	0.368	
	0.307	
	0.246	
	0.129	
	0.134	
	0.14	
	0.133	
	0.135	
	0.173	
	0.29	
	0.387	
	0.366	
	0.381	
	0.393	

Ratio average for 1993:
0.34402

Daily Ratios for 1991:

June	July	August	September
0.289	1.387	2.351	2.211
0.81	1.897	2.68	2.625
0.86	1.923	2.891	2.733
0.927	1.736	3.268	3.16
1.037	1.243	2.259	3.125
1.142	1.194	2.771	3.217
1.248	1.291	2.977	3.318
1.361	1.363	3	3.227
1.514	1.453	2.825	3.19
1.434	2	2.581	3.318
1.358	2.217	3.026	2.654
	2.211	3.139	1.741
	1.95	3.257	
	1.713	1.895	
	1.943	1.37	
	2.529	1.413	
	3.4	1.414	
	3.532	1.258	
	3.396	1.569	
	3.511	2.25	
	3.457	1.953	
	2.673	2	
	2.72	2.231	
	2.939	2.486	
	2.958	2.583	
	3.156	2.421	
	3.333	2.447	
	3.366	1.86	
	3.195		
	2.841		
	1.899		

Ratio average for 1991:
2.281707

7.2 APPENDIX B- YIELD TABLES

Table 1A. Calculated methyl mercury yields for the North Division. Sampling sites are arranged upstream to downstream.

	MeHg Yield (ng m^{-2} $month^{-1}$)		
Month	RR22	RR20	RR16
June /05	1.15×10^{-6}	5.20×10^{-7}	2.04×10^{-7}
July/05	8.69×10^{-7}	1.89×10^{-7}	9.83×10^{-8}
August /05	9.44×10^{-7}	2.47×10^{-7}	1.05×10^{-7}
September /05	5.26×10^{-7}		2.87×10^{-8}
October /05	8.69×10^{-7}	3.55×10^{-7}	1.42×10^{-7}
November /05	5.14×10^{-7}		9.20×10^{-8}
February /06	2.37×10^{-7}		3.82×10^{-8}
March /06	3.07×10^{-8}	1.30×10^{-8}	5.41×10^{-9}
April /06	1.96×10^{-7}		2.67×10^{-8}
May /06	1.50×10^{-7}	2.83×10^{-8}	1.70×10^{-8}
June /06	4.56×10^{-7}		7.71×10^{-8}
August /06	1.15×10^{-6}		1.98×10^{-7}
Sum of applicable months	7.09×10^{-6}	1.35×10^{-6}	1.03×10^{-6}
Average	6.69×10^{-7}	2.25×10^{-7}	9.53×10^{-8}
Net Yield		-4.43×10^{-7}	-1.30×10^{-7}

Table 1B. Calculated total mercury yields for the North Division. Sampling sites are arranged upstream to downstream.

	THg Yield (ng m^{-2} $month^{-1}$)		
Month	RR22	RR20	RR16
June /05	6.11×10^{-6}	2.18×10^{-6}	1.23×10^{-6}
July/05	3.01×10^{-6}	9.55×10^{-7}	4.82×10^{-7}
August /05	4.61×10^{-6}	1.77×10^{-6}	5.97×10^{-7}
September /05	2.82×10^{-6}		4.59×10^{-7}
October /05	1.04×10^{-5}	2.66×10^{-6}	1.53×10^{-6}
November /05			6.87×10^{-7}
February /06	2.89×10^{-6}		4.13×10^{-7}
March /06	4.95×10^{-7}	2.04×10^{-7}	8.96×10^{-8}
April /06	2.65×10^{-6}		4.16×10^{-7}
May /06	3.91×10^{-6}	1.24×10^{-6}	5.71×10^{-7}
June /06	6.66×10^{-6}		8.64×10^{-7}
August /06	6.11×10^{-6}		8.43×10^{-7}
Sum of applicable months	4.97×10^{-5}	9.01×10^{-6}	8.18×10^{-6}
Average	4.75×10^{-6}	1.50×10^{-6}	7.50×10^{-7}
Net Yield		-3.25×10^{-6}	-7.52×10^{-7}

Table 1C. Calculated sulphate yields for the North Division. Sampling sites are arranged upstream to downstream.

	Sulphate Yield (mg m^{-2} month^{-1})		
Month	RR22	RR20	RR16
June /05	3.56×10^{-5}	1.38×10^{-5}	7.44×10^{-6}
July/05	1.46×10^{-5}	7.26×10^{-6}	3.11×10^{-6}
August /05	2.60×10^{-5}	1.11×10^{-5}	6.91×10^{-6}
September /05	2.54×10^{-5}		3.69×10^{-6}
October /05	7.33×10^{-5}	1.50×10^{-5}	8.45×10^{-6}
November /05	2.80×10^{-5}		5.75×10^{-6}
February /06	2.12×10^{-5}		3.82×10^{-6}
March /06	1.38×10^{-6}	7.21×10^{-7}	5.63×10^{-7}
April /06	9.80×10^{-6}		3.12×10^{-6}
May /06	1.58×10^{-5}	8.50×10^{-6}	3.74×10^{-6}
June /06	1.73×10^{-5}		2.57×10^{-6}
August /06	1.75×10^{-5}		2.28×10^{-6}
Sum of applicable months	2.86×10^{-4}	5.64×10^{-5}	5.14×10^{-5}
Average	2.78×10^{-5}	9.41×10^{-6}	5.04×10^{-6}
Net Yield		-1.84×10^{-5}	-4.37×10^{-6}

Table 1D. Calculated total phosphorus yields for the North Division. Sampling sites are arranged upstream to downstream.

	Total Phosphorus Yield (μg m^{-2} month^{-1})		
Month	RR22	RR20	RR16
June /05	7.85×10^{-5}	3.77×10^{-5}	2.74×10^{-5}
July/05	2.43×10^{-5}	1.54×10^{-5}	8.76×10^{-6}
August /05	1.27×10^{-4}	6.65×10^{-5}	1.08×10^{-5}
September /05	1.23×10^{-5}		3.22×10^{-6}
October /05	3.82×10^{-5}	1.66×10^{-5}	1.21×10^{-5}
November /05	9.65×10^{-6}		6.57×10^{-6}
February /06	2.49×10^{-5}		5.35×10^{-6}
March /06	3.70×10^{-6}	2.38×10^{-6}	1.10×10^{-6}
April /06	3.27×10^{-5}		7.79×10^{-6}
May /06	2.91×10^{-5}	1.19×10^{-5}	6.63×10^{-6}
June /06	2.98×10^{-5}		6.74×10^{-6}
August /06	5.41×10^{-5}		1.30×10^{-5}
Sum of applicable months	4.65×10^{-4}	1.50×10^{-4}	1.09×10^{-4}
Average	5.02×10^{-5}	2.51×10^{-5}	1.11×10^{-5}
Net Yield		-2.51×10^{-5}	-1.40×10^{-5}

Table 1E. Calculated nitrate yields for the North Division. Sampling sites are arranged upstream to downstream.

	Nitrate Yield (μg m^{-2} $month^{-1}$)		
Month	RR22	RR20	RR16
June /05	1.39×10^{-4}	9.42×10^{-5}	1.08×10^{-4}
July/05	9.85×10^{-6}	7.22×10^{-5}	1.65×10^{-5}
August /05	8.01×10^{-5}	4.34×10^{-5}	1.30×10^{-5}
September /05	2.10×10^{-5}		4.55×10^{-5}
October /05	2.85×10^{-3}	7.42×10^{-4}	3.49×10^{-4}
November /05	1.35×10^{-3}		1.91×10^{-4}
February /06	5.67×10^{-4}		1.07×10^{-4}
March /06	4.54×10^{-5}	3.58×10^{-5}	9.52×10^{-6}
April /06	8.06×10^{-5}		2.29×10^{-5}
May /06	2.94×10^{-4}	2.44×10^{-5}	8.06×10^{-5}
June /06	4.24×10^{-5}		4.14×10^{-5}
August /06	1.66×10^{-4}		4.69×10^{-5}
Sum of applicable months	5.64×10^{-3}	1.01×10^{-3}	1.03×10^{-3}
Average	5.69×10^{-4}	1.69×10^{-4}	9.61×10^{-5}
Net Yield		-4.00×10^{-4}	-7.26×10^{-5}

Table 1F. Calculated ammonia yields for the North Division. Sampling sites are arranged upstream to downstream.

	Ammonia Yield (μg m^{-2} $month^{-1}$)		
Month	RR22	RR20	RR16
June /05	1.17×10^{-4}	3.99×10^{-5}	1.49×10^{-5}
July/05	2.61×10^{-5}	2.80×10^{-5}	7.82×10^{-6}
August /05	1.51×10^{-4}	2.99×10^{-5}	9.42×10^{-6}
September /05	1.40×10^{-5}		5.37×10^{-6}
October /05	5.21×10^{-5}	8.28×10^{-6}	7.10×10^{-6}
November /05	2.09×10^{-5}		5.92×10^{-6}
February /06	6.11×10^{-5}		8.41×10^{-6}
March /06	1.34×10^{-5}	4.76×10^{-6}	1.90×10^{-6}
April /06	1.74×10^{-5}		6.68×10^{-7}
May /06	2.83×10^{-5}	1.70×10^{-6}	1.36×10^{-6}
June /06	4.24×10^{-5}		1.16×10^{-5}
August /06	4.14×10^{-5}		6.83×10^{-6}
Sum of applicable months	5.86×10^{-4}	1.13×10^{-4}	8.13×10^{-5}
Average	6.48×10^{-5}	1.88×10^{-5}	7.09×10^{-6}
Net Yield		-4.60×10^{-5}	-1.17×10^{-5}

Table 1G. Calculated DOC yields for the North Division. Sampling sites are arranged upstream to downstream.

	DOC Yield (mg m^{-2} $month^{-1}$)		
Month	RR22	RR20	RR16
June /05	6.31×10^{-5}	1.58×10^{-5}	8.37×10^{-6}
July/05	3.53×10^{-5}	9.47×10^{-6}	4.26×10^{-6}
August /05	7.46×10^{-5}	2.69×10^{-5}	7.40×10^{-6}
September /05	3.86×10^{-5}		4.30×10^{-6}
October /05	7.30×10^{-5}	2.01×10^{-5}	9.23×10^{-6}
November /05	2.41×10^{-5}		3.29×10^{-6}
February /06	1.99×10^{-5}		2.80×10^{-6}
March /06	2.65×10^{-6}	7.21×10^{-7}	3.68×10^{-7}
April /06	1.85×10^{-5}		2.67×10^{-6}
May /06	3.16×10^{-5}	9.06×10^{-6}	4.76×10^{-6}
June /06	4.40×10^{-5}		5.78×10^{-6}
August /06	4.78×10^{-5}		7.48×10^{-6}
Sum of applicable months	4.73×10^{-4}	8.21×10^{-5}	6.07×10^{-5}
Average	4.67×10^{-5}	1.37×10^{-5}	5.73×10^{-6}
Net Yield		-3.30×10^{-5}	-7.92×10^{-6}

Table 1H. Calculated DIC yields for the North Division. Sampling sites are arranged upstream to downstream.

	DIC Yield (mg m^{-2} $month^{-1}$)		
Month	RR22	RR20	RR16
June /05	8.85×10^{-5}	3.47×10^{-5}	2.06×10^{-5}
July/05	5.97×10^{-5}	2.09×10^{-5}	1.31×10^{-5}
August /05	1.26×10^{-4}	4.04×10^{-5}	2.51×10^{-5}
September /05	9.46×10^{-5}		1.97×10^{-5}
October /05	1.01×10^{-4}	4.14×10^{-5}	2.63×10^{-5}
November /05	4.50×10^{-5}		1.15×10^{-5}
February /06	3.99×10^{-5}		9.94×10^{-6}
March /06	5.72×10^{-6}	1.66×10^{-6}	1.41×10^{-6}
April /06	3.38×10^{-5}		8.90×10^{-6}
May /06	5.74×10^{-5}	2.32×10^{-5}	1.39×10^{-5}
June /06	6.28×10^{-5}		1.57×10^{-5}
August /06	6.53×10^{-5}		1.56×10^{-5}
Sum of applicable months	7.80×10^{-4}	1.62×10^{-4}	1.82×10^{-4}
Average	7.30×10^{-5}	2.70×10^{-5}	1.67×10^{-5}
Net Yield		-4.60×10^{-5}	-1.03×10^{-5}

Table 1I. Calculated specific conductivity yields for the North Division. Sampling sites are arranged upstream to downstream.

	Specific Conductivity Yield (mg m^{-2} month^{-1})		
Month	RR22	RR20	RR16
June /05	7.29×10^{-4}	2.51×10^{-4}	1.47×10^{-4}
July/05	5.42×10^{-4}	1.40×10^{-4}	8.49×10^{-5}
August /05	1.23×10^{-3}	2.80×10^{-4}	1.45×10^{-4}
September /05	1.25×10^{-3}		1.42×10^{-4}
October /05	8.57×10^{-4}	3.16×10^{-4}	1.91×10^{-4}
November /05	3.53×10^{-4}		8.24×10^{-5}
February /06			7.20×10^{-5}
March /06	4.02×10^{-5}	1.34×10^{-5}	7.70×10^{-6}
April /06	2.45×10^{-4}		5.68×10^{-5}
May /06	3.98×10^{-4}	1.51×10^{-4}	8.92×10^{-5}
June /06	4.40×10^{-4}		9.78×10^{-5}
August /06			
Sum of applicable months	6.07×10^{-3}	1.15×10^{-3}	1.12×10^{-3}
Average	6.32×10^{-4}	1.92×10^{-4}	1.11×10^{-4}
Net Yield		-4.40×10^{-4}	-8.10×10^{-5}

Table 1J. Calculated dissolved oxygen yields for the North Division. Sampling sites are arranged upstream to downstream.

	Dissolved Oxygen Yield (mg m^{-2} month^{-1})		
Month	RR22	RR20	RR16
June /05	1.77×10^{-5}	5.14×10^{-6}	3.02×10^{-6}
July/05	5.19×10^{-6}	2.35×10^{-6}	1.30×10^{-6}
August /05	6.54×10^{-6}	4.04×10^{-6}	1.91×10^{-6}
September /05	1.07×10^{-5}		3.22×10^{-6}
October /05	3.13×10^{-5}	1.12×10^{-5}	7.95×10^{-6}
November /05	1.68×10^{-5}		4.02×10^{-6}
February /06			3.40×10^{-6}
March /06	1.74×10^{-6}	7.20×10^{-7}	4.88×10^{-7}
April /06	1.04×10^{-5}		2.63×10^{-6}
May /06	1.54×10^{-5}	7.00×10^{-6}	4.07×10^{-6}
June /06	1.52×10^{-5}		1.91×10^{-6}
August /06			
Sum of applicable months	1.31×10^{-4}	3.05×10^{-5}	3.39×10^{-5}
Average	1.30×10^{-5}	5.08×10^{-6}	3.12×10^{-6}
Net Yield		-7.92×10^{-6}	-1.96×10^{-6}

Table 2A. Calculated methyl mercury yields for the Main Division. Sampling sites are arranged upstream to downstream.

	MeHg Yield (ng m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	1.29×10^{-6}	2.83×10^{-6}	1.08×10^{-6}	4.67×10^{-7}	3.00×10^{-7}
July/05	9.92×10^{-7}	7.14×10^{-7}	1.79×10^{-7}	1.03×10^{-7}	1.09×10^{-7}
August /05	1.53×10^{-6}	1.03×10^{-6}	2.48×10^{-7}	2.22×10^{-7}	1.05×10^{-7}
September /05	7.06×10^{-7}				8.15×10^{-8}
October /05	1.05×10^{-6}	1.46×10^{-6}	5.37×10^{-7}	3.67×10^{-7}	1.70×10^{-7}
November /05	4.86×10^{-7}				1.02×10^{-7}
February /06	2.51×10^{-7}				4.57×10^{-8}
March /06	5.06×10^{-8}		2.01×10^{-8}		7.77×10^{-9}
April /06	1.78×10^{-7}				4.53×10^{-8}
May /06	3.45×10^{-7}	9.44×10^{-7}	1.68×10^{-7}	1.62×10^{-7}	4.88×10^{-8}
June /06	5.54×10^{-7}				1.19×10^{-7}
August /06	9.61×10^{-7}				2.30×10^{-7}
Sum of applicable months	8.40×10^{-6}	6.99×10^{-6}	2.23×10^{-6}	1.32×10^{-6}	1.36×10^{-6}
Average	1.04×10^{-6}	1.40×10^{-6}	4.42×10^{-7}	2.64×10^{-7}	1.47×10^{-7}
Net Yield		3.55×10^{-7}	-9.55×10^{-7}	-1.78×10^{-7}	-1.18×10^{-7}

Table 2B. Calculated total mercury yields for the Main Division. Sampling sites are arranged upstream to downstream.

	THg Yield (ng m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	9.06×10^{-6}	1.43×10^{-5}	5.08×10^{-6}	3.33×10^{-6}	2.17×10^{-6}
July/05	3.60×10^{-6}	9.88×10^{-6}	1.63×10^{-6}	1.29×10^{-6}	4.45×10^{-7}
August /05	5.22×10^{-6}	7.40×10^{-6}	1.98×10^{-6}	1.54×10^{-6}	8.99×10^{-7}
September /05	4.52×10^{-6}				6.77×10^{-7}
October /05	1.71×10^{-5}	1.62×10^{-5}	5.41×10^{-6}	3.82×10^{-6}	1.95×10^{-6}
November /05	7.53×10^{-6}				9.24×10^{-7}
February /06	4.30×10^{-6}				6.28×10^{-7}
March /06	8.60×10^{-7}		4.28×10^{-7}		1.45×10^{-7}
April /06	3.78×10^{-6}				5.14×10^{-7}
May /06	7.81×10^{-6}	8.04×10^{-6}	2.47×10^{-6}	1.82×10^{-6}	9.18×10^{-7}
June /06	8.98×10^{-6}				1.01×10^{-6}
August /06	6.35×10^{-6}				1.78×10^{-6}
Sum of applicable months	7.91×10^{-5}	5.59×10^{-5}	1.70×10^{-5}	1.18×10^{-5}	1.21×10^{-5}
Average	8.57×10^{-6}	1.12×10^{-5}	3.32×10^{-6}	2.36×10^{-6}	1.28×10^{-6}
Net Yield		2.61×10^{-6}	-7.85×10^{-6}	-9.60×10^{-7}	-1.08×10^{-6}

Table 2C. Calculated sulphate yields for the Main Division. Sampling sites are arranged upstream to downstream.

	Sulphate Yield (mg m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	5.12×10^{-5}	7.03×10^{-5}	2.63×10^{-5}	1.63×10^{-5}	1.01×10^{-5}
July/05	2.44×10^{-5}	3.18×10^{-5}	1.41×10^{-5}	7.05×10^{-6}	4.20×10^{-6}
August /05	4.16×10^{-5}	5.71×10^{-5}	2.72×10^{-5}	1.75×10^{-5}	8.94×10^{-6}
September /05	4.41×10^{-5}				8.02×10^{-6}
October /05	7.61×10^{-5}	9.35×10^{-5}	2.23×10^{-5}	3.13×10^{-5}	1.81×10^{-5}
November /05	3.30×10^{-5}				6.41×10^{-6}
February /06	1.88×10^{-5}				4.57×10^{-6}
March /06	2.40×10^{-6}		1.64×10^{-6}		6.47×10^{-7}
April /06	1.64×10^{-5}				3.99×10^{-6}
May /06	2.72×10^{-5}	3.78×10^{-5}	1.78×10^{-5}	1.19×10^{-5}	6.10×10^{-6}
June /06	2.97×10^{-5}				5.38×10^{-6}
August /06	3.41×10^{-5}				5.45×10^{-6}
Sum of applicable months	3.99×10^{-4}	2.90×10^{-4}	1.09×10^{-4}	8.40×10^{-5}	8.19×10^{-5}
Average	4.41×10^{-5}	5.81×10^{-5}	2.15×10^{-5}	1.68×10^{-5}	9.49×10^{-6}
Net Yield		1.40×10^{-5}	-3.65×10^{-5}	-4.74×10^{-6}	-7.31×10^{-6}

Table 2D. Calculated total phosphorus yields for the Main Division. Sampling sites are arranged upstream to downstream.

	Total Phosphorus Yield (μg m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	1.00×10^{-4}	1.45×10^{-4}	6.71×10^{-5}	4.67×10^{-5}	2.68×10^{-5}
July/05	1.31×10^{-5}	1.47×10^{-4}	1.38×10^{-5}	1.08×10^{-5}	9.50×10^{-6}
August /05	7.46×10^{-5}	1.85×10^{-4}	3.26×10^{-5}	3.34×10^{-5}	1.23×10^{-5}
September /05	2.43×10^{-5}				4.84×10^{-5}
October /05	0	1.13×10^{-4}	7.85×10^{-5}	1.06×10^{-4}	2.72×10^{-5}
November /05	0				1.18×10^{-5}
February /06	2.35×10^{-5}				7.01×10^{-6}
March /06	6.39×10^{-6}		4.41×10^{-6}		1.50×10^{-6}
April /06	3.29×10^{-5}				7.46×10^{-6}
May /06	3.87×10^{-5}	6.74×10^{-5}	1.98×10^{-5}	1.48×10^{-5}	9.56×10^{-6}
June /06	1.78×10^{-5}				9.61×10^{-6}
August /06	3.20×10^{-5}				2.02×10^{-5}
Sum of applicable months	3.64×10^{-4}	6.57×10^{-4}	2.16×10^{-4}	2.11×10^{-4}	1.91×10^{-4}
Average	4.53×10^{-5}	1.31×10^{-4}	4.24×10^{-5}	4.23×10^{-5}	1.71×10^{-5}
Net Yield		8.61×10^{-5}	-8.90×10^{-5}	-1.16×10^{-7}	-2.52×10^{-5}

Table 2E. Calculated nitrate yields for the Main Division. Sampling sites are arranged upstream to downstream.

Average	Nitrate Yield (µg m^{-2} month^{-1})				
Month	RR21	RR19	RR18	RR17	RR15
June /05	1.30×10^{-4}	9.04×10^{-4}	3.34×10^{-4}	5.18×10^{-5}	1.75×10^{-4}
July/05	5.91×10^{-5}	2.91×10^{-4}	1.03×10^{-4}	4.50×10^{-5}	1.18×10^{-5}
August /05	1.52×10^{-5}	5.87×10^{-5}	4.18×10^{-5}	1.21×10^{-5}	8.05×10^{-7}
September /05	1.38×10^{-3}				2.11×10^{-4}
October /05	2.09×10^{-3}	3.74×10^{-3}	1.25×10^{-3}	8.32×10^{-5}	8.66×10^{-4}
November /05	5.16×10^{-4}				3.10×10^{-4}
February /06	3.78×10^{-4}				2.03×10^{-4}
March /06	7.20×10^{-5}		3.34×10^{-5}		1.59×10^{-5}
April /06	1.32×10^{-4}				3.97×10^{-5}
May /06	2.31×10^{-4}	3.59×10^{-4}	1.29×10^{-4}	3.86×10^{-5}	2.20×10^{-4}
June /06	1.33×10^{-4}				7.76×10^{-5}
August /06	1.74×10^{-4}				1.39×10^{-4}
Sum of applicable months	5.31×10^{-3}	5.35×10^{-3}	1.89×10^{-3}	1.45×10^{-3}	2.27×10^{-3}
Average	5.04×10^{-4}	1.07×10^{-3}	3.72×10^{-4}	2.89×10^{-4}	2.55×10^{-4}
Net Yield		5.65×10^{-3}	-6.98×10^{-4}	-8.24×10^{-5}	-3.43×10^{-5}

Table 2F. Calculated ammonia yields for the Main Division. Sampling sites are arranged upstream to downstream.

	Ammonia Yield ($\mu g\ m^{-2}\ month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	2.51×10^{-4}	2.22×10^{-4}	7.11×10^{-5}	3.55×10^{-5}	2.87×10^{-5}
July/05	6.85×10^{-5}	3.95×10^{-5}	1.72×10^{-5}	7.83×10^{-6}	5.81×10^{-6}
August /05	9.12×10^{-5}	9.61×10^{-5}	2.87×10^{-5}	1.48×10^{-5}	4.03×10^{-6}
September /05	1.54×10^{-4}				4.29×10^{-6}
October /05	9.18×10^{-5}	1.07×10^{-4}	2.07×10^{-5}	1.76×10^{-5}	7.65×10^{-6}
November /05	4.25×10^{-5}				1.06×10^{-5}
February /06	9.88×10^{-5}				1.16×10^{-5}
March /06	1.70×10^{-5}		7.93×10^{-6}		3.08×10^{-6}
April /06	3.15×10^{-5}				2.40×10^{-6}
May /06	3.98×10^{-5}	2.70×10^{-5}	6.93×10^{-6}	7.73×10^{-6}	9.36×10^{-6}
June /06	9.49×10^{-5}				1.15×10^{-5}
August /06	1.34×10^{-4}				1.99×10^{-5}
Sum of applicable months	1.12×10^{-3}	4.92×10^{-4}	1.53×10^{-4}	8.35×10^{-5}	1.19×10^{-4}
Average	1.08×10^{-4}	9.84×10^{-5}	2.89×10^{-5}	1.67×10^{-5}	1.11×10^{-5}
Net Yield		-9.98×10^{-5}	-6.95×10^{-5}	-1.22×10^{-5}	-5.60×10^{-6}

Table 2G. Calculated DOC yields for the Main Division. Sampling sites are arranged upstream to downstream.

	DOC Yield (mg m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	9.19×10^{-5}	1.26×10^{-4}	3.68×10^{-5}	2.43×10^{-5}	1.22×10^{-5}
July/05	4.23×10^{-5}	5.64×10^{-5}	1.45×10^{-5}	1.03×10^{-5}	6.52×10^{-6}
August /05	7.32×10^{-5}	1.10×10^{-4}	2.87×10^{-5}	1.85×10^{-5}	1.23×10^{-5}
September /05	7.28×10^{-5}				7.29×10^{-6}
October /05	1.40×10^{-4}	1.18×10^{-4}	3.51×10^{-5}	2.35×10^{-5}	1.19×10^{-5}
November /05	4.86×10^{-5}				3.93×10^{-6}
February /06	3.45×10^{-5}				3.96×10^{-6}
March /06	4.80×10^{-6}		1.26×10^{-6}		5.18×10^{-7}
April /06	2.88×10^{-5}				3.46×10^{-6}
May /06	5.13×10^{-5}	6.20×10^{-5}	1.88×10^{-5}	1.19×10^{-5}	6.31×10^{-6}
June /06	6.13×10^{-5}				6.92×10^{-6}
August /06	7.81×10^{-5}				9.73×10^{-6}
Sum of applicable months	7.27×10^{-4}	4.73×10^{-4}	1.35×10^{-4}	8.85×10^{-5}	8.51×10^{-5}
Average	7.97×10^{-5}	9.45×10^{-5}	2.68×10^{-5}	1.77×10^{-5}	9.85×10^{-6}
Net Yield		1.48×10^{-5}	-6.77×10^{-5}	-9.09×10^{-6}	-7.86×10^{-6}

Table 2H. Calculated DIC yields for the Main Division. Sampling sites are arranged upstream to downstream.

	DIC Yield (mg m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	5.29×10^{-5}	1.20×10^{-4}	5.00×10^{-5}	3.64×10^{-5}	2.14×10^{-5}
July/05	4.67×10^{-5}	7.51×10^{-5}	3.31×10^{-5}	2.35×10^{-5}	1.30×10^{-5}
August /05	1.28×10^{-4}	1.62×10^{-4}	6.79×10^{-5}	4.73×10^{-4}	2.63×10^{-5}
September /05	5.73×10^{-5}				2.01×10^{-5}
October /05	7.00×10^{-5}	1.69×10^{-4}	6.82×10^{-5}	5.28×10^{-5}	3.23×10^{-5}
November /05	2.83×10^{-5}				1.42×10^{-5}
February /06	2.04×10^{-5}				1.13×10^{-5}
March /06	4.00×10^{-6}		2.64×10^{-6}		1.53×10^{-6}
April /06	1.78×10^{-5}				1.01×10^{-5}
May /06	2.72×10^{-5}	7.28×10^{-5}	3.36×10^{-5}	2.39×10^{-5}	1.53×10^{-5}
June /06	4.15×10^{-5}				1.88×10^{-5}
August /06	4.81×10^{-5}				1.56×10^{-5}
Sum of applicable months	5.43×10^{-4}	5.99×10^{-4}	2.55×10^{-4}	1.84×10^{-4}	2.00×10^{-4}
Average	6.50×10^{-5}	1.12×10^{-4}	5.06×10^{-5}	3.68×10^{-5}	2.17×10^{-5}
Net Yield		5.48×10^{-5}	-6.92×10^{-5}	-1.38×10^{-5}	-1.51×10^{-5}

Table 2I. Calculated specific conductivity yields for the Main Division. Sampling sites are arranged upstream to downstream.

	Specific Conductivity Yield (mg m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	4.19×10^{-4}	9.18×10^{-4}	3.82×10^{-4}	2.77×10^{-4}	1.66×10^{-4}
July/05	3.03×10^{-4}	5.05×10^{-4}	2.26×10^{-4}	1.62×10^{-4}	8.94×10^{-5}
August /05	7.49×10^{-4}	9.36×10^{-4}	4.40×10^{-4}	3.29×10^{-4}	1.71×10^{-4}
September /05	4.26×10^{-4}				1.55×10^{-4}
October /05	5.68×10^{-4}	1.30×10^{-3}	5.18×10^{-4}	4.01×10^{-4}	2.41×10^{-4}
November /05	2.44×10^{-4}				1.04×10^{-4}
February /06	1.94×10^{-4}				8.76×10^{-5}
March /06	3.18×10^{-5}		2.03×10^{-5}		8.56×10^{-6}
April /06	1.33×10^{-4}				6.87×10^{-5}
May /06	3.35×10^{-4}	5.47×10^{-4}	2.54×10^{-4}	1.88×10^{-4}	1.08×10^{-4}
June /06	2.75×10^{-4}				1.24×10^{-4}
August /06					
Sum of applicable months	3.68×10^{-3}	4.21×10^{-3}	1.84×10^{-3}	1.36×10^{-3}	1.32×10^{-3}
Average	4.75×10^{-4}	8.41×10^{-4}	3.64×10^{-4}	2.72×10^{-4}	1.55×10^{-4}
Net Yield		3.66×10^{-4}	-4.77×10^{-4}	-9.22×10^{-5}	-1.16×10^{-4}

Table 2J. Calculated dissolved oxygen yields for the Main Division. Sampling sites are arranged upstream to downstream.

	Dissolved Oxygen Yield (mg m^{-2} $month^{-1}$)				
Month	RR21	RR19	RR18	RR17	RR15
June /05	1.80×10^{-5}	2.16×10^{-5}	8.95×10^{-6}	7.29×10^{-6}	3.30×10^{-6}
July/05	7.68×10^{-6}	1.13×10^{-5}	4.06×10^{-6}	3.67×10^{-6}	1.15×10^{-6}
August /05	1.82×10^{-5}	1.58×10^{-5}	5.69×10^{-6}	3.73×10^{-6}	2.75×10^{-6}
September /05	1.32×10^{-5}				3.12×10^{-6}
October /05	4.07×10^{-5}	5.66×10^{-5}	2.29×10^{-5}	1.85×10^{-5}	9.60×10^{-6}
November /05	2.04×10^{-5}				4.42×10^{-6}
February /06	1.76×10^{-5}				3.75×10^{-6}
March /06	2.16×10^{-6}		1.30×10^{-6}		5.62×10^{-7}
April /06	1.41×10^{-5}				2.57×10^{-6}
May /06	1.82×10^{-5}	2.93×10^{-5}	9.65×10^{-6}	7.95×10^{-6}	3.85×10^{-6}
June /06	1.50×10^{-5}				2.46×10^{-6}
August /06					
Sum of applicable months	1.85×10^{-4}	1.35×10^{-4}	5.26×10^{-5}	4.11×10^{-5}	3.75×10^{-5}
Average	2.05×10^{-5}	2.69×10^{-5}	1.03×10^{-5}	8.23×10^{-6}	4.13×10^{-6}
Net Yield		6.39×10^{-6}	-1.67×10^{-5}	-2.03×10^{-6}	-4.09×10^{-6}

Table 3A. Calculated methyl mercury yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	MeHg Yield (ng m^{-2} $month^{-1}$)		
Month	RR13	RR12	RR7
June /05	1.03×10^{-7}	1.03×10^{-7}	6.69×10^{-8}
July/05	3.94×10^{-8}	2.32×10^{-8}	2.99×10^{-8}
August /05			1.95×10^{-8}
September /05			1.84×10^{-8}
October /05	7.38×10^{-8}	7.28×10^{-8}	5.89×10^{-8}
November /05			2.98×10^{-8}
February /06			1.31×10^{-8}
March /06			2.39×10^{-9}
April /06			
May /06	2.47×10^{-8}	2.38×10^{-8}	1.48×10^{-8}
June /06			
August /06			
Sum of applicable months	2.41×10^{-7}	2.23×10^{-7}	2.54×10^{-7}
Average	6.04×10^{-8}	5.57×10^{-8}	4.26×10^{-8}
Net Yield		-4.64×10^{-9}	-1.31×10^{-8}

Table 3B. Calculated total mercury yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	THg Yield (ng m^{-2} $month^{-1}$)		
Month	RR13	RR12	RR7
June /05	8.56×10^{-7}	6.87×10^{-7}	4.67×10^{-7}
July/05	4.31×10^{-7}	2.74×10^{-7}	8.97×10^{-8}
August /05	3.85×10^{-7}	3.41×10^{-7}	1.66×10^{-7}
September /05			2.42×10^{-7}
October /05	1.00×10^{-6}	8.80×10^{-7}	7.76×10^{-7}
November /05			3.16×10^{-7}
February /06			1.15×10^{-7}
March /06			5.26×10^{-8}
April /06			
May /06	3.22×10^{-7}	2.98×10^{-7}	2.16×10^{-7}
June /06			
August /06			
Sum of applicable months	2.99×10^{-6}	2.48×10^{-6}	2.44×10^{-6}
Average	6.52×10^{-7}	5.34×10^{-7}	3.87×10^{-7}
Net Yield		-1.18×10^{-7}	-1.47×10^{-7}

Table 3C. Calculated sulphate yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	Sulphate Yield (mg m^{-2} $month^{-1}$)		
Month	RR13	RR12	RR7
June /05	4.18×10^{-6}	3.96×10^{-6}	3.22×10^{-6}
July/05	2.06×10^{-6}	1.82×10^{-6}	1.54×10^{-6}
August /05	3.83×10^{-6}	3.11×10^{-6}	2.82×10^{-6}
September /05			3.01×10^{-6}
October /05	7.86×10^{-6}	7.01×10^{-6}	4.74×10^{-6}
November /05			2.65×10^{-6}
February /06			1.81×10^{-6}
March /06			1.71×10^{-7}
April /06			
May /06	2.65×10^{-6}	1.90×10^{-6}	2.15×10^{-6}
June /06			
August /06			
Sum of applicable months	2.06×10^{-5}	1.78×10^{-5}	2.21×10^{-5}
Average	4.19×10^{-6}	3.67×10^{-6}	2.91×10^{-6}
Net Yield		-5.16×10^{-7}	-7.61×10^{-7}

Table 3D. Calculated total phosphorus yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	Total Phosphorus Yield ($\mu g\ m^{-2}\ month^{-1}$)		
Month	RR13	RR12	RR7
June /05	1.58×10^{-5}	1.47×10^{-5}	9.99×10^{-6}
July/05	7.02×10^{-6}	6.29×10^{-6}	5.51×10^{-6}
August /05	1.38×10^{-5}	1.36×10^{-5}	4.43×10^{-6}
September /05			2.12×10^{-6}
October /05	1.62×10^{-5}	1.39×10^{-5}	3.08×10^{-6}
November /05			3.63×10^{-6}
February /06			2.81×10^{-6}
March /06			9.73×10^{-7}
April /06			
May /06	1.05×10^{-5}	9.48×10^{-6}	5.22×10^{-6}
June /06		-1.02×10^{-6}	-4.26×10^{-6}
August /06			
Sum of applicable months	5.58×10^{-5}	5.15×10^{-5}	3.48×10^{-5}
Average	1.05×10^{-5}	9.48×10^{-6}	5.22×10^{-6}
Net Yield		-1.02×10^{-6}	-4.26×10^{-6}

Table 3E. Calculated nitrate yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	Nitrate Yield ($\mu g\ m^{-2}\ month^{-1}$)		
Month	RR13	RR12	RR7
June /05	2.21×10^{-4}	2.17×10^{-4}	3.14×10^{-5}
July/05	4.93×10^{-7}	2.21×10^{-6}	6.36×10^{-6}
August /05	2.33×10^{-6}	1.25×10^{-6}	1.15×10^{-6}
September /05			2.91×10^{-5}
October /05	3.58×10^{-4}	3.55×10^{-4}	4.46×10^{-5}
November /05			8.51×10^{-5}
February /06			4.70×10^{-5}
March /06			8.50×10^{-6}
April /06			
May /06	2.25×10^{-5}	3.45×10^{-5}	3.70×10^{-5}
June /06			
August /06			
Sum of applicable months	6.04×10^{-4}	6.10×10^{-4}	2.90×10^{-4}
Average	1.50×10^{-4}	1.52×10^{-4}	2.98×10^{-5}
Net Yield		1.72×10^{-6}	-1.20×10^{-4}

Table 3F. Calculated ammonia yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	Ammonia Yield (μg m^{-2} month^{-1})		
Month	RR13	RR12	RR7
June /05	1.53×10^{-5}	2.11×10^{-5}	7.94×10^{-6}
July/05	8.62×10^{-7}	4.74×10^{-6}	2.71×10^{-6}
August /05	6.30×10^{-6}	1.46×10^{-6}	1.86×10^{-6}
September /05			2.83×10^{-6}
October /05	7.38×10^{-6}	6.95×10^{-6}	3.08×10^{-6}
November /05			3.11×10^{-6}
February /06			3.22×10^{-6}
March /06			1.88×10^{-6}
April /06			
May /06	1.59×10^{-6}	1.11×10^{-6}	8.05×10^{-7}
June /06			
August /06			
Sum of applicable months	3.14×10^{-5}	3.53×10^{-5}	2.74×10^{-5}
Average	6.28×10^{-6}	8.46×10^{-6}	3.64×10^{-6}
Net Yield		2.19×10^{-6}	-4.83×10^{-6}

Table 3G. Calculated DOC yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	DOC Yield (mg m^{-2} month^{-1})		
Month	RR13	RR12	RR7
June /05	4.70×10^{-6}	3.58×10^{-6}	3.03×10^{-6}
July/05	2.46×10^{-6}	2.21×10^{-6}	1.78×10^{-6}
August /05	5.36×10^{-6}	4.18×10^{-6}	2.92×10^{-6}
September /05			1.84×10^{-6}
October /05	5.17×10^{-6}	4.30×10^{-6}	4.48×10^{-6}
November /05			1.17×10^{-6}
February /06			1.11×10^{-6}
March /06			1.20×10^{-7}
April /06			
May /06	2.30×10^{-6}	2.06×10^{-6}	1.74×10^{-6}
June /06			
August /06			
Sum of applicable months	2.00×10^{-5}	1.63×10^{-5}	1.82×10^{-5}
Average	3.66×10^{-6}	3.04×10^{-6}	2.76×10^{-6}
Net Yield		-6.22×10^{-7}	-2.77×10^{-7}

Table 3H. Calculated DIC yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	DIC Yield (mg m^{-2} month^{-1})		
Month	RR13	RR12	RR7
June /05	9.64 x 10^{-6}	8.85 x 10^{-6}	7.32 x 10^{-6}
July/05	5.79 x 10^{-6}	5.41 x 10^{-6}	4.49 x 10^{-6}
August /05	1.07 x 10^{-5}	9.61 x 10^{-6}	8.59 x 10^{-6}
September /05			6.36 x 10^{-6}
October /05	1.44 x 10^{-5}	1.29 x 10^{-5}	1.18 x 10^{-5}
November /05			4.93 x 10^{-6}
February /06			3.92 x 10^{-6}
March /06			4.10 x 10^{-7}
April /06			
May /06	6.72 x 10^{-6}	6.02 x 10^{-6}	5.10 x 10^{-6}
June /06			
August /06			
Sum of applicable months	4.73 x 10^{-5}	4.28 x 10^{-5}	5.29 x 10^{-5}
Average	9.14 x 10^{-6}	8.29 x 10^{-6}	7.17 x 10^{-6}
Net Yield		-8.43 x 10^{-7}	-1.12 x 10^{-6}

Table 3I. Calculated specific conductivity yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	Specific Conductivity Yield (mg m^{-2} month^{-1})		
Month	RR13	RR12	RR7
June /05	7.51 x 10^{-5}	6.91 x 10^{-5}	5.72 x 10^{-5}
July/05	4.01 x 10^{-5}	3.55 x 10^{-5}	3.02 x 10^{-5}
August /05	7.46 x 10^{-5}	6.53 x 10^{-5}	5.55 x 10^{-5}
September /05			4.73 x 10^{-5}
October /05	1.06 x 10^{-4}	9.72 x 10^{-5}	8.89 x 10^{-5}
November /05			
February /06			2.94 x 10^{-5}
March /06			3.21 x 10^{-6}
April /06			2.35 x 10^{-5}
May /06	4.87 x 10^{-5}	4.43 x 10^{-5}	3.80 x 10^{-5}
June /06			
August /06			
Sum of applicable months	3.45 x 10^{-4}	3.11 x 10^{-4}	3.73 x 10^{-4}
Average	6.75 x 10^{-5}	6.15 x 10^{-5}	5.36 x 10^{-5}
Net Yield		-5.99 x 10^{-6}	-7.97 x 10^{-6}

Table 3J. Calculated dissolved oxygen yields for the North + Main Division. Sampling sites are arranged upstream to downstream.

	Dissolved Oxygen Yield (mg m^{-2} $month^{-1}$)		
Month	RR13	RR12	RR7
June /05	1.57×10^{-6}	1.33×10^{-6}	1.24×10^{-6}
July/05	7.29×10^{-7}	5.76×10^{-7}	6.51×10^{-7}
August /05	1.15×10^{-6}	9.95×10^{-7}	1.03×10^{-6}
September /05			1.10×10^{-6}
October /05	4.25×10^{-6}	9.72×10^{-6}	2.72×10^{-6}
November /05			
February /06			1.37×10^{-6}
March /06			1.97×10^{-7}
April /06			9.20×10^{-7}
May /06	1.64×10^{-6}	4.30×10^{-6}	1.25×10^{-6}
June /06			
August /06			
Sum of applicable months	9.33×10^{-6}	1.48×10^{-6}	1.05×10^{-5}
Average	2.04×10^{-6}	1.92×10^{-6}	1.46×10^{-6}
Net Yield		-1.23×10^{-7}	-4.58×10^{-7}

Table 4A. Calculated methyl mercury yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	MeHg Yield (ng m^{-2} $month^{-1}$)
Month	RR6
June /05	3.53×10^{-8}
July/05	1.45×10^{-8}
August /05	2.37×10^{-8}
September /05	1.80×10^{-8}
October /05	4.16×10^{-8}
November /05	1.92×10^{-8}
February /06	
March /06	1.75×10^{-9}
April /06	
May /06	1.85×10^{-8}
June /06	1.79×10^{-8}
August /06	
Sum of applicable months	1.90×10^{-7}
Average	2.12×10^{-8}
Net Yield	-5.33×10^{-8}

Table 4B. Calculated total mercury yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	THg Yield (ng m^{-2} month^{-1})
Month	RR6
June /05	1.59 x 10^{-7}
July/05	5.28 x 10^{-8}
August /05	1.11 x 10^{-7}
September /05	1.09 x 10^{-7}
October /05	3.92 x 10^{-7}
November /05	2.19 x 10^{-7}
February /06	
March /06	2.50 x 10^{-8}
April /06	
May /06	1.96 x 10^{-7}
June /06	1.81 x 10^{-7}
August /06	
Sum of applicable months	1.44 x 10^{-6}
Average	1.60 x 10^{-7}
Net Yield	

Table 4C. Calculated sulphate yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	Sulphate Yield (mg m^{-2} month^{-1})
Month	RR6
June /05	2.53 x 10^{-6}
July/05	1.19 x 10^{-6}
August /05	2.11 x 10^{-6}
September /05	2.02 x 10^{-6}
October /05	3.03 x 10^{-6}
November /05	1.31 x 10^{-6}
February /06	
March /06	1.75 x 10^{-7}
April /06	
May /06	8.05 x 10^{-7}
June /06	1.43 x 10^{-6}
August /06	
Sum of applicable months	1.46 x 10^{-5}
Average	1.62 x 10^{-6}
Net Yield	

Table 4D. Calculated total phosphorus yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	Total Phosphorus Yield ($\mu g\ m^{-2}\ month^{-1}$)
Month	RR6
June /05	9.32×10^{-6}
July/05	8.97×10^{-6}
August /05	1.32×10^{-5}
September /05	2.49×10^{-6}
October /05	3.36×10^{-6}
November /05	2.56×10^{-6}
February /06	
March /06	5.36×10^{-7}
April /06	
May /06	1.99×10^{-6}
June /06	2.86×10^{-6}
August /06	
Sum of applicable months	4.54×10^{-5}
Average	5.04×10^{-6}
Net Yield	

Table 4E. Calculated nitrate yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	Nitrate Yield ($\mu g\ m^{-2}\ month^{-1}$)
Month	RR6
June /05	2.73×10^{-5}
July/05	1.39×10^{-6}
August /05	2.81×10^{-6}
September /05	4.48×10^{-5}
October /05	1.67×10^{-4}
November /05	9.80×10^{-5}
February /06	
March /06	7.75×10^{-6}
April /06	
May /06	6.44×10^{-5}
June /06	5.69×10^{-5}
August /06	
Sum of applicable months	4.70×10^{-4}
Average	5.23×10^{-5}
Net Yield	

Table 4F. Calculated ammonia yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	Ammonia Yield (μg m^{-2} $month^{-1}$)
Month	RR6
June /05	1.23×10^{-5}
July/05	2.18×10^{-6}
August /05	2.75×10^{-6}
September /05	6.69×10^{-6}
October /05	3.76×10^{-6}
November /05	1.83×10^{-6}
February /06	
March /06	1.01×10^{-6}
April /06	
May /06	1.66×10^{-6}
June /06	7.78×10^{-6}
August /06	
Sum of applicable months	4.00×10^{-5}
Average	4.44×10^{-6}
Net Yield	

Table 4G. Calculated DOC yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	DOC Yield (mg m^{-2} $month^{-1}$)
Month	RR6
June /05	1.76×10^{-6}
July/05	1.06×10^{-6}
August /05	1.69×10^{-6}
September /05	1.40×10^{-6}
October /05	2.97×10^{-6}
November /05	8.24×10^{-7}
February /06	
March /06	9.04×10^{-8}
April /06	
May /06	1.18×10^{-6}
June /06	1.16×10^{-6}
August /06	
Sum of applicable months	1.21×10^{-5}
Average	1.35×10^{-6}
Net Yield	

Table 4H. Calculated DIC yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	DIC Yield (mg m^{-2} $month^{-1}$)
Month	RR6
June /05	5.17×10^{-6}
July/05	3.17×10^{-6}
August /05	5.62×10^{-6}
September /05	4.59×10^{-6}
October /05	8.71×10^{-6}
November /05	3.57×10^{-6}
February /06	
March /06	3.74×10^{-7}
April /06	
May /06	3.69×10^{-6}
June /06	4.47×10^{-6}
August /06	
Sum of applicable months	3.94×10^{-5}
Average	4.37×10^{-6}
Net Yield	

Table 4I. Calculated specific conductivity yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	Specific Conductivity Yield (mg m^{-2} $month^{-1}$)
Month	RR6
June /05	4.35×10^{-5}
July/05	2.29×10^{-5}
August /05	4.22×10^{-5}
September /05	3.85×10^{-5}
October /05	6.65×10^{-5}
November /05	2.87×10^{-5}
February /06	
March /06	2.41×10^{-6}
April /06	1.75×10^{-5}
May /06	2.70×10^{-5}
June /06	3.05×10^{-5}
August /06	
Sum of applicable months	3.20×10^{-4}
Average	3.36×10^{-5}
Net Yield	

Table 4J. Calculated dissolved oxygen yields for the Composite Division. Sampling sites are arranged upstream to downstream.

	Dissolved Oxygen Yield ($mg\ m^{-2}\ month^{-1}$)
Month	RR6
June /05	5.04×10^{-7}
July/05	4.45×10^{-7}
August /05	5.11×10^{-7}
September /05	5.76×10^{-7}
October /05	1.82×10^{-6}
November /05	1.11×10^{-6}
February /06	
March /06	1.29×10^{-7}
April /06	7.07×10^{-7}
May /06	1.00×10^{-6}
June /06	6.33×10^{-7}
August /06	
Sum of applicable months	7.45×10^{-6}
Average	7.49×10^{-7}
Net Yield	

Table 5A. Calculated methyl mercury yields for the South Division. Sampling sites are arranged upstream to downstream.

	MeHg Yield ($ng\ m^{-2}\ month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	2.77×10^{-6}	5.75×10^{-7}	7.10×10^{-7}	2.13×10^{-7}	1.27×10^{-7}
July/05	3.33×10^{-7}	1.63×10^{-7}	8.26×10^{-8}	4.73×10^{-8}	3.89×10^{-8}
August /05	9.74×10^{-7}	3.45×10^{-7}	2.22×10^{-7}	1.47×10^{-7}	6.55×10^{-8}
September /05		2.09×10^{-7}			5.66×10^{-8}
October /05	2.45×10^{-6}	7.15×10^{-7}	2.48×10^{-7}	1.81×10^{-7}	1.55×10^{-7}
November /05		4.35×10^{-7}		1.25×10^{-7}	1.08×10^{-7}
February /06					4.34×10^{-8}
March /06		2.41×10^{-8}	2.01×10^{-8}		6.84×10^{-9}
April /06		8.26×10^{-8}			1.89×10^{-8}
May /06	3.04×10^{-7}	7.21×10^{-8}	3.95×10^{-8}	1.85×10^{-8}	4.55×10^{-8}
June /06	7.38×10^{-7}				6.64×10^{-8}
August /06		1.14×10^{-6}			2.18×10^{-7}
Sum of applicable months	7.57×10^{-6}	3.76×10^{-6}	1.32×10^{-6}	7.32×10^{-7}	9.50×10^{-7}
Average	1.01×10^{-6}	3.24×10^{-7}	1.48×10^{-7}	9.38×10^{-8}	7.63×10^{-8}
Net Yield		-6.91×10^{-7}	-1.76×10^{-7}	-4.97×10^{-8}	-1.75×10^{-8}

Table 5B. Calculated total mercury yields for the South Division. Sampling sites are arranged upstream to downstream.

	THg Yield (ng m^{-2} $month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	9.87×10^{-6}	5.98×10^{-6}	9.95×10^{-6}	3.15×10^{-6}	8.58×10^{-7}
July/05	0	2.64×10^{-7}	1.79×10^{-7}	9.03×10^{-8}	1.08×10^{-7}
August /05	3.82×10^{-5}	1.57×10^{-6}	9.65×10^{-7}	8.23×10^{-7}	5.21×10^{-7}
September /05		2.66×10^{-6}			4.49×10^{-7}
October /05	1.29×10^{-5}	6.47×10^{-6}	4.23×10^{-6}	3.69×10^{-6}	1.83×10^{-6}
November /05		2.49×10^{-6}		1.75×10^{-6}	1.41×10^{-6}
February /06					4.28×10^{-7}
March /06		2.30×10^{-7}	2.92×10^{-7}		1.07×10^{-7}
April /06		9.43×10^{-7}			2.87×10^{-7}
May /06	3.26×10^{-6}	1.62×10^{-6}	3.12×10^{-6}	3.33×10^{-7}	5.05×10^{-7}
June /06	7.50×10^{-6}				6.52×10^{-7}
August /06		3.90×10^{-6}			1.17×10^{-6}
Sum of applicable months	7.17×10^{-5}	2.61×10^{-5}	1.87×10^{-5}	9.83×10^{-6}	8.33×10^{-6}
Average	1.36×10^{-5}	2.48×10^{-6}	2.13×10^{-6}	1.23×10^{-6}	7.41×10^{-7}
Net Yield		-1.11×10^{-5}	-3.56×10^{-7}	-8.92×10^{-7}	-4.89×10^{-7}

Table 5C. Calculated sulphate yields for the South Division. Sampling sites are arranged upstream to downstream.

	Sulphate Yield (mg m^{-2} $month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	1.22×10^{-4}	2.44×10^{-5}	1.96×10^{-5}	1.69×10^{-5}	1.16×10^{-5}
July/05	5.44×10^{-5}	1.38×10^{-5}	7.58×10^{-6}	7.31×10^{-6}	4.90×10^{-6}
August /05	1.15×10^{-4}	2.48×10^{-5}	9.13×10^{-6}	3.26×10^{-6}	7.94×10^{-6}
September /05		1.14×10^{-5}			3.05×10^{-6}
October /05	1.90×10^{-4}	7.90×10^{-5}	4.34×10^{-5}	2.06×10^{-5}	1.81×10^{-5}
November /05		2.26×10^{-5}		6.80×10^{-6}	4.80×10^{-6}
February /06					5.58×10^{-6}
March /06		2.52×10^{-6}	2.01×10^{-6}		7.89×10^{-7}
April /06		1.89×10^{-5}			4.87×10^{-6}
May /06	5.21×10^{-5}	3.06×10^{-5}	1.58×10^{-5}	1.11×10^{-5}	7.24×10^{-6}
June /06	3.28×10^{-5}				6.25×10^{-6}
August /06		2.59×10^{-5}			6.73×10^{-6}
Sum of applicable months	5.67×10^{-4}	2.54×10^{-4}	9.75×10^{-5}	6.60×10^{-5}	8.19×10^{-5}
Average	1.03×10^{-4}	3.71×10^{-5}	1.90×10^{-5}	1.06×10^{-5}	9.55×10^{-6}
Net Yield		-6.58×10^{-5}	-1.81×10^{-5}	-8.40×10^{-6}	-1.05×10^{-6}

Table 5D. Calculated total phosphorus yields for the South Division. Sampling sites are arranged upstream to downstream.

	Total Phosphorus Yield ($\mu g\ m^{-2}\ month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	9.35×10^{-4}	1.58×10^{-4}	1.75×10^{-4}	9.20×10^{-5}	4.10×10^{-5}
July/05	3.93×10^{-5}	2.38×10^{-5}	8.26×10^{-6}	2.02×10^{-5}	6.63×10^{-6}
August /05	9.16×10^{-4}	6.54×10^{-5}	3.00×10^{-5}	3.83×10^{-5}	1.94×10^{-5}
September /05		5.32×10^{-5}			6.54×10^{-6}
October /05	1.18×10^{-4}	6.02×10^{-5}	2.89×10^{-5}	3.61×10^{-5}	4.06×10^{-5}
November /05		1.92×10^{-5}		3.46×10^{-5}	1.56×10^{-5}
February /06					6.82×10^{-6}
March /06		4.82×10^{-6}	6.29×10^{-6}		2.29×10^{-6}
April /06		4.25×10^{-5}			6.23×10^{-6}
May /06	7.81×10^{-5}	1.28×10^{-4}	1.48×10^{-5}	1.23×10^{-5}	8.89×10^{-6}
June /06	1.11×10^{-4}				1.29×10^{-5}
August /06		7.59×10^{-5}			2.53×10^{-5}
Sum of applicable months	2.20×10^{-3}	6.31×10^{-4}	2.63×10^{-4}	2.34×10^{-4}	1.92×10^{-4}
Average	2.88×10^{-4}	6.93×10^{-5}	2.05×10^{-5}	2.67×10^{-5}	1.89×10^{-5}
Net Yield		-2.19×10^{-4}	-4.88×10^{-5}	6.24×10^{-6}	-7.80×10^{-6}

Table 5E. Calculated nitrate yields for the South Division. Sampling sites are arranged upstream to downstream.

	Nitrate Yield ($\mu g\ m^{-2}\ month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	1.33×10^{-4}	2.27×10^{-4}	5.91×10^{-4}	2.11×10^{-3}	1.65×10^{-4}
July/05	2.69×10^{-4}	1.63×10^{-5}	7.58×10^{-6}	6.80×10^{-5}	2.59×10^{-6}
August /05	9.05×10^{-4}	3.92×10^{-5}	1.36×10^{-4}	1.87×10^{-5}	3.00×10^{-6}
September /05		3.28×10^{-4}			2.96×10^{-4}
October /05	3.51×10^{-3}	4.71×10^{-4}	7.83×10^{-4}	1.61×10^{-3}	7.63×10^{-4}
November /05		2.87×10^{-4}		5.19×10^{-4}	7.01×10^{-4}
February /06					1.29×10^{-4}
March /06		1.53×10^{-5}	3.42×10^{-5}		3.02×10^{-5}
April /06		5.90×10^{-6}			8.36×10^{-5}
May /06	1.09×10^{-4}	9.01×10^{-6}	7.12×10^{-5}	1.43×10^{-4}	3.03×10^{-4}
June /06	1.64×10^{-4}				2.87×10^{-4}
August /06		7.41×10^{-5}			2.95×10^{-4}
Sum of applicable months	5.09×10^{-3}	1.47×10^{-3}	1.62×10^{-3}	4.47×10^{-3}	3.06×10^{-3}
Average	1.20×10^{-3}	1.34×10^{-4}	2.49×10^{-4}	4.60×10^{-4}	2.68×10^{-4}
Net Yield		-1.06×10^{-3}	1.16×10^{-4}	2.10×10^{-4}	-1.92×10^{-4}

Table 5F. Calculated ammonia yields for the South Division. Sampling sites are arranged upstream to downstream.

	Ammonia Yield ($\mu g\ m^{-2}\ month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	1.52×10^{-3}	1.19×10^{-4}	6.58×10^{-5}	1.40×10^{-4}	4.65×10^{-5}
July/05	3.33×10^{-5}	2.13×10^{-5}	1.52×10^{-5}	1.89×10^{-5}	4.75×10^{-6}
August /05	1.17×10^{-3}	4.64×10^{-5}	4.57×10^{-5}	3.99×10^{-5}	6.00×10^{-6}
September /05		2.66×10^{-5}			1.13×10^{-5}
October /05	1.72×10^{-4}	7.53×10^{-5}	1.03×10^{-5}	6.45×10^{-6}	1.47×10^{-5}
November /05		6.97×10^{-6}		1.73×10^{-5}	9.19×10^{-6}
February /06					1.12×10^{-5}
March /06		4.59×10^{-6}	3.15×10^{-6}		3.84×10^{-6}
April /06		5.90×10^{-6}			2.71×10^{-6}
May /06	1.09×10^{-5}	3.60×10^{-6}	4.94×10^{-6}	2.47×10^{-6}	6.82×10^{-6}
June /06	1.02×10^{-4}	1.04×10^{-4}			1.29×10^{-5}
August /06					2.53×10^{-5}
Sum of applicable months	3.01×10^{-3}	4.13×10^{-4}	1.45×10^{-4}	2.25×10^{-4}	1.55×10^{-4}
Average	3.48×10^{-4}	3.66×10^{-5}	1.90×10^{-5}	1.69×10^{-5}	8.07×10^{-6}
Net Yield		-3.11×10^{-4}	-1.76×10^{-5}	-2.08×10^{-6}	-8.83×10^{-6}

Table 5G. Calculated DOC yields for the South Division. Sampling sites are arranged upstream to downstream.

	DOC Yield ($mg\ m^{-2}\ month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05	5.77×10^{-5}	2.04×10^{-5}	1.32×10^{-5}	7.39×10^{-6}	4.95×10^{-6}
July/05	9.07×10^{-6}	7.53×10^{-6}	4.13×10^{-6}	2.15×10^{-6}	2.02×10^{-6}
August /05	1.72×10^{-5}	1.19×10^{-5}	6.52×10^{-6}	4.89×10^{-6}	3.55×10^{-6}
September /05		1.52×10^{-5}			3.05×10^{-6}
October /05	6.35×10^{-5}	3.39×10^{-5}	1.65×10^{-5}	7.74×10^{-6}	6.91×10^{-6}
November /05		1.04×10^{-5}		3.58×10^{-6}	2.00×10^{-6}
February /06					1.55×10^{-6}
March /06		9.17×10^{-7}	5.03×10^{-7}		2.11×10^{-7}
April /06		7.08×10^{-6}			1.62×10^{-6}
May /06	3.04×10^{-5}	1.08×10^{-5}	5.93×10^{-6}	3.09×10^{-6}	2.69×10^{-6}
June /06	4.51×10^{-5}				3.12×10^{-6}
August /06		2.24×10^{-5}			4.75×10^{-6}
Sum of applicable months	2.23×10^{-4}	1.41×10^{-4}	4.68×10^{-5}	2.88×10^{-5}	3.64×10^{-5}
Average	3.00×10^{-5}	1.60×10^{-5}	8.28×10^{-6}	4.47×10^{-6}	3.79×10^{-6}
Net Yield		-1.40×10^{-5}	-7.75×10^{-6}	-3.81×10^{-6}	-6.80×10^{-7}

Table 5H. Calculated DIC yields for the South Division. Sampling sites are arranged upstream to downstream.

	DIC Yield (mg m^{-2} month^{-1})				
Month	RR1	RR2	RR3	RR4	RR5
June /05	2.94 x 10^{-4}	9.11 x 10^{-5}	3.55 x 10^{-5}	3.12 x 10^{-5}	2.28 x 10^{-5}
July/05	7.86 x 10^{-5}	5.02 x 10^{-5}	2.96 x 10^{-5}	1.98 x 10^{-5}	1.30 x 10^{-5}
August /05	1.60 x 10^{-4}	7.96 x 10^{-5}	5.48 x 10^{-5}	3.75 x 10^{-5}	2.51 x 10^{-5}
September /05		1.03 x 10^{-4}			2.27 x 10^{-5}
October /05	5.35 x 10^{-4}	1.69 x 10^{-4}	9.29 x 10^{-5}	5.80 x 10^{-5}	4.06 x 10^{-5}
November /05		6.97 x 10^{-5}		2.21 x 10^{-5}	1.64 x 10^{-5}
February /06					1.49 x 10^{-5}
March /06		9.17 x 10^{-6}	4.03 x 10^{-6}		1.87 x 10^{-6}
April /06		6.13 x 10^{-5}			1.27x 10^{-5}
May /06	2.21 x 10^{-4}	9.19 x 10^{-5}	5.14 x 10^{-5}	3.27 x 10^{-5}	1.90 x 10^{-5}
June /06	2.50 x 10^{-4}				2.03 x 10^{-5}
August /06		8.79 x 10^{-5}			1.66 x 10^{-5}
Sum of applicable months	1.54 x 10^{-3}	8.13 x 10^{-4}	2.68 x 10^{-4}	2.01 x 10^{-4}	2.26 x 10^{-4}
Average	2.49 x 10^{-4}	9.78 x 10^{-5}	5.72 x 10^{-5}	3.70 x 10^{-5}	2.44 x 10^{-5}
Net Yield		-1.51 x 10^{-4}	-4.06 x 10^{-5}	-2.02 x 10^{-5}	-1.26 x 10^{-5}

Table 5I. Calculated specific conductivity yields for the South Division. Sampling sites are arranged upstream to downstream.

	Specific Conductivity Yield (mg m^{-2} month^{-1})				
Month	RR1	RR2	RR3	RR4	RR5
June /05		8.23 x 10^{-4}	3.98 x 10^{-4}	3.24 x 10^{-4}	2.21 x 10^{-4}
July/05	7.06 x 10^{-4}	4.29 x 10^{-4}	2.68 x 10^{-4}	1.98 x 10^{-4}	1.21 x 10^{-4}
August /05	1.39 x 10^{-3}	6.82 x 10^{-4}	4.87 x 10^{-4}	3.63 x 10^{-4}	2.19. x 10^{-4}
September /05		1.03 x 10^{-3}			2.05 x 10^{-4}
October /05	4.75 x 10^{-3}	1.37 x 10^{-3}	7.71 x 10^{-4}	5.00 x 10^{-4}	3.42 x 10^{-4}
November /05		5.56 x 10^{-4}		2.08 x 10^{-4}	1.38 x 10^{-4}
February /06					1.38 x 10^{-4}
March /06		7.64 x 10^{-5}	4.23 x 10^{-5}		1.38 x 10^{-5}
April /06		4.85 x 10^{-4}			1.02 x 10^{-4}
May /06	1.71 x 10^{-3}	5.25 x 10^{-4}		1.70 x 10^{-4}	1.57 x 10^{-5}
June /06	1.78 x 10^{-3}				1.68 x 10^{-4}
August /06					
Sum of applicable months	1.03 x 10^{-2}	5.98 x 10^{-3}	1.97 x 10^{-3}	1.76 x 10^{-3}	1.83 x 10^{-3}
Average	2.28 x 10^{-3}	8.28 x 10^{-4}	5.09 x 10^{-4}	3.54 x 10^{-4}	2.10 x 10^{-4}
Net Yield		-1.45 x 10^{-3}	-3.19 x 10^{-4}	-1.55 x 10^{-4}	-1.44 x 10^{-4}

Table 5J. Calculated dissolved oxygen yields for the South Division. Sampling sites are arranged upstream to downstream.

	Dissolved Oxygen Yield (mg m^{-2} $month^{-1}$)				
Month	RR1	RR2	RR3	RR4	RR5
June /05		1.09×10^{-5}	6.90×10^{-6}	4.48×10^{-6}	2.76×10^{-6}
July/05	3.39×10^{-5}	1.49×10^{-5}	4.94×10^{-6}	2.37×10^{-6}	1.48×10^{-6}
August /05	4.21×10^{-5}	1.90×10^{-5}	1.30×10^{-5}	5.46×10^{-6}	2.80×10^{-6}
September /05		1.83×10^{-5}			3.53×10^{-6}
October /05	6.85×10^{-3}	3.24×10^{-5}	1.87×10^{-5}	1.20×10^{-5}	7.52×10^{-6}
November /05		1.97×10^{-5}		6.06×10^{-6}	4.14×10^{-6}
February /06					3.94×10^{-6}
March /06		2.54×10^{-6}	1.33×10^{-6}		5.78×10^{-7}
April /06		1.40×10^{-5}			3.06×10^{-6}
May /06	4.85×10^{-5}	1.94×10^{-5}		7.15×10^{-6}	4.34×10^{-6}
June /06	3.96×10^{-5}				2.47×10^{-6}
August /06					
Sum of applicable months	2.33×10^{-4}	1.51×10^{-4}	4.49×10^{-5}	3.75×10^{-5}	3.66×10^{-5}
Average	4.82×10^{-5}	2.14×10^{-5}	9.50×10^{-6}	6.74×10^{-6}	4.03×10^{-6}
Net Yield		-2.68×10^{-5}	-1.19×10^{-5}	-2.76×10^{-6}	-2.71×10^{-6}

7.3 APPENDIX C- DATA COLLECTED

Data of the 5 Divisions of the Raisin River

North Division

Table 6A. MeHg concentrations (ng L^{-1}) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	0.52	0.52	0.48	1.02	0.55	0.31	0.3	0.25	0.32
RR20	0.69		0.48		0.33			0.3	
RR16	0.47	0.43	0.48	0.35	0.25	0.22	0.08	0.2	0.28

Table 6B. MeHg concentrations (ng L^{-1}) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	0.19	0.17	0.12	0.18	0.05	0.13	0.29	0.72
RR20		0.18			0.05			
RR16	0.15	0.15	0.1	0.12	0.05		0.24	0.61

Table 6C. THg concentrations (ng L^{-1}) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	2.66	2.86	3.47	1.73	1.98	2.22	1.61	2.99	
RR20	2.89		2.42		2.37			2.25	
RR16	3	2.43	2.99	1.08	1.27	1.39	1.28	2.16	2.09

Table 6D. THg concentrations (ng L^{-1}) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	2.32	2.65	2.03	2.43	2.44	2.26	4.24	3.84
RR20		2.83			2.19			
RR16	1.62	2.56	1.58	1.87	1.68		2.69	2.59

Table 6E. Percentage of THg as MeHg for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	19.5	18.2	13.8	59	27.8	14	18.6	8.4	
RR20	23.9		19.8		13.9			13.3	
RR16	15.7	17.7	16.1	32.4	19.7	15.8	6.3	9.3	13.4

Table 6F. Percentage of THg as MeHg for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	8.2	6.4	5.9	7.4	2	5.8	6.8	18.8
RR20		6.4			2.3			
RR16	9.3	5.9	6.3	6.4	3		8.9	23.6

Table 6G. Sulphate concentrations (mg L^{-1}) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	17	15.2	12.2	12.8	11.5	12.2	14.5	21.1	17.4
RR20	18.3		18.4		14.9			12.7	
RR16	17.2	15.7	13	13.3	12.9	17.9	10.3	11.9	17.5

Table 6H. Sulphate concentrations (mg L^{-1}) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	17	3	10	9	10	9	11	11
RR20		10			15			
RR16	15	9	17	14	15	7	8	7

Table 6I. Total phosphorus concentrations (μg L^{-1}) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	43	28	18	24	73	43	7	11	6
RR20	50		39		89			14	
RR16	41	80	47	27	32	16	9	17	20

Table 6J. Total phosphorus concentrations (μg L^{-1}) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	20	18	17	30	17	18	19	34
RR20		33			21			
RR16	21	33	18	35	17	22	21	40

Table 6K. Nitrate concentrations (μg L^{-1}) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	101	25	13	4	47	26	12	819	839
RR20	125		183		58			627	
RR16	339	140	68	71	22	36	127	491	582

Table 6L. Nitrate concentrations ($\mu g\ L^{-1}$) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	455	243	186	74	46	307	27	104
RR20		496			43			
RR16	421	219	221	103	42	432	129	144

Table 6M. Ammonia concentrations ($\mu g\ L^{-1}$) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	86	20	16	29	73	65	8	15	13
RR20	53		71		40			7	
RR16	33	33	36	30	22	20	15	10	18

Table 6N. Ammonia concentrations ($\mu g\ L^{-1}$) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	49	45	82	16	15	19	27	26
RR20		66			3			
RR16	33	61	27	3	4	4	36	21

Table 6O. DOC concentrations (ppm) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	26	31	29	32	34	34	22	21	15
RR20	21		24		36			17	
RR16	18	19	19	17	15	18	12	13	10

Table 6P. DOC concentrations (ppm) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	16	11	14	17	19	19	28	30
RR20		10			16			
RR16	11	7	10	12	13	15	18	23

Table 6Q. DIC concentrations (ppm) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	42	38	48	55	57	58	54	29	28
RR20	46		53		54			35	
RR16	46	45	56	55	56	56	55	37	35

Table 6R. DIC concentrations (ppm) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22	32	24	30	31	34	33	40	41
RR20		23			41			
RR16	39	26	39	40	42	40	49	48

Table 6S. Specific conductivity readings ($\mu S\ cm^{-1}$) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	529	459		701	846	830	1066	370	329
RR20	500		532		561			400	
RR16	489	487	576	499	507	461	593	404	376

Table 6T. Specific conductivity readings ($\mu S\ cm^{-1}$) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22		285		337	376	342.6	420	
RR20		278			401			
RR16	424	267		383	408	379	457	

Table 6U. Dissolved oxygen concentrations ($mg\ L^{-1}$) for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	8.5	7.54	6.46	2.5	2.68	3.28	6.12	9.02	10.45
RR20	6.82		5.95		5.4			9.5	
RR16	8.22	5.14	4.8	6.2	3.46	5.03	9	11.2	12.22

Table 6V. Dissolved oxygen concentrations ($mg\ L^{-1}$) for the North Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR22		8.2		9.53	10.06	8.5	9.65	
RR20		9.99			12.35			
RR16	13.33	11.27		11.81	12.95	11	5.94	

Table 6W. Percentage of oxygen saturation for the North Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR22	93	91	79	27	22	33	59	73	75
RR20	73		68		61			77	
RR16	90	60	54	70	37	53	89	91	99

Table 6X. Percentage of oxygen saturation for the North Division from February to June 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06
RR22		55		96	106	85	115
RR20		68			121		
RR16	90	76		106	128	101	66

Main Division

Table 7A. MeHg concentrations (ng L^{-1}) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	0.5	0.43	0.49	0.87	0.68	0.43	0.32	0.24	0.24
RR19	0.73	0.85	0.38		0.33	0.25		0.26	
RR18	0.82		0.26		0.19			0.26	
RR17	0.5		0.21		0.24			0.25	
RR15	0.58	0.53	0.29	0.48	0.18	0.21	0.19	0.2	0.26

Table 7B. MeHg concentrations (ng L^{-1}) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	0.16	0.18	0.2	0.13	0.13	0.2	0.28	0.48
RR19					0.35			
RR18		0.16			0.17			
RR17					0.23			
RR15	0.15	0.14	0.16	0.17	0.13	0.11	0.31	0.59

Table 7C. THg concentrations (ng L^{-1}) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	3.12	3.39	3.19	1.75	2.16	1.62	2.05	3.92	3.72
RR19	3.73	4.25	5.26		2.55	1.61		2.88	
RR18	3.86		2.37		1.52			2.62	
RR17	3.56		2.63		1.66			2.6	
RR15	4.9	3.13	2.02	1.12	1.25	2.1	1.58	2.29	2.35

Table 7D. THg concentrations (ng L^{-1}) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	2.74	3.54	2.92	2.76		3.73	4.54	3.17
RR19					2.98			
RR18		3.4			2.5			
RR17					2.59			
RR15	2.06	3.16	2.43	1.93	2.21	2.3	2.64	4.57

Table 7E. Percentage of THg as MeHg for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	16	12.7	15.4	49.7	31.5	26.5	15.6	6.1	6.5
RR19	19.6	20	7.2		12.9	15.5		9	
RR18	21.2		11		12.5			9.9	
RR17	14		8		14.5			9.6	
RR15	11.8	16.9	14.4	42.9	14.4	10	12	8.7	11.1

Table 7F. Percentage of THg as MeHg for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	5.8	5.1	6.8	4.7		5.4	6.2	15.1
RR19					11.7			
RR18		4.7			6.8			
RR17					8.9			
RR15	7.3	4.4	6.6	8.8	5.9	4.8	11.7	12.9

Table 7G. Sulphate concentrations (mg L^{-1}) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	17.7	19.1	16.9	16.5	13.7	16.4	20	17.4	16.3
RR19	19	20.2	16.9		16.6	15.5		16.6	
RR18	20		20.5		20.8			10.8	
RR17	17.4		14.4		18.9			21.3	
RR15	19.7	17.7	17.3	12.3	16.9	16.4	18.7	21.3	16.3

Table 7H. Sulphate concentrations (mg L^{-1}) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	12	9	9	12	12	14	15	17
RR19					14			
RR18		13			18			
RR17					17			
RR15	15	7	18	15	16	14	14	14

Table 7I. Total phosphorus concentrations (μg L^{-1}) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	48	24	4	14	28	26	11	0	0
RR19	38	43	78		44	60		20	
RR18	51		20		25			38	
RR17	50		22		36			72	
RR15	54	45	34	33	24	22	113	32	30

Table 7J. Total phosphorus concentrations (μg L^{-1}) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	15	29	19	24	19	18	9	16
RR19					25			
RR18		35			20			
RR17					21			
RR15	23	39	19	28	28	19	25	52

Table 7K. Nitrate concentrations (μg L^{-1}) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	39	54	69	12	11	0	626	477	255
RR19	338	166	155		13	20		663	
RR18	254		149		32			605	
RR17	554		92		13			567	
RR15	482	165	36	47	3	0	492	1019	789

Table 7L. Nitrate concentrations (μg L^{-1}) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	241	360	181	96	92	129	67	87
RR19					133			
RR18		265			130			
RR17					55			
RR15	665	327	286	149	133	950	202	357

Table 7M. Ammonia concentrations (μg L^{-1}) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	120	60	40	54	47	19	70	21	21
RR19	91	33	21		27	27		19	
RR18	54		25		22			10	
RR17	38		16		16			12	
RR15	58	48	23	18	11	4	10	9	27

Table 7N. Ammonia concentrations (μg L^{-1}) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	63	42	86	23	16	22	48	67
RR19					10			
RR18		63			7			
RR17					11			
RR15	38	86	33	9	25	21	30	51

Table 7O. DOC concentrations (ppm) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	31	35	29	29	26	27	33	32	24
RR19	32	38	30		34	28		21	
RR18	28		21		22			17	
RR17	26		21		20			16	
RR15	22	23	21	25	23	23	17	14	10

Table 7P. DOC concentrations (ppm) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	22	17	19	21	22	27	31	39
RR19					23			
RR18		10			19			
RR17					17			
RR15	13	8	12	13	14	17	18	25

Table 7Q. DIC concentrations (ppm) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	18	20	26	38	48	45	26	16	14
RR19	35	32	40		44	47		30	
RR18	38		48		52			33	
RR17	39		48		51			36	
RR15	40	39	46	46	49	49	47	38	36

Table 7R. DIC concentrations (ppm) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	13	15	15	13	13	13	21	24
RR19					27			
RR18		21			34			
RR17					34			
RR15	37	23	36	38	37	38	49	40

Table 7S. Specific conductivity readings ($\mu S\ cm^{-1}$) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	220	232	267	357	445	368	290	195	181
RR19	397	371	403		384.1	405		346	
RR18	435		491		505			376	
RR17	445		497		532			410	
RR15	460	458	486	460	498	457	543	425	398

Table 7T. Specific conductivity readings ($\mu S\ cm^{-1}$) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	186	179		146	346	134.4	209	
RR19					304			
RR18		242			385			
RR17					402			
RR15	431	248		387	417	382.6	483	

Table 7U. Dissolved oxygen concentrations ($mg\ L^{-1}$) for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	6.35	6.55	6.52	4.02	6.86	6.29	6	9.3	10.1
RR19	5.9	6.15	6.04		2.53	6.32		10.05	
RR18	6.8		5.89		4.36			11.1	
RR17	7.8		7.49		4.02			12.6	
RR15	6.83	5.36	3.52	4.6	4.76	5.5	7.27	11.3	11.25

Table 7V. Dissolved oxygen concentrations ($mg\ L^{-1}$) for the Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR21	11.22	8.09		10.3	9.51	7.89	7.58	
RR19					10.85			
RR18		10.36			9.75			
RR17					11.32			
RR15	12.3	10.85		9.65	8.34	10.55	6.4	

Table 7W. Percentage of oxygen saturation for the Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR21	65	76	79	43	80	70	59	74	77
RR19	62	72	67		25	70		80	
RR18	72		65		48			90	
RR17	85		85		45			102	
RR15	75	65	40	53	55	60	73	92	87

Table 7X. Percentage of oxygen saturation for the Main Division from February to June 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06
RR21	80	58		102	80	77	85
RR19					102		
RR18		70			93		
RR17					108		
RR15	85	74		88	80	94	73

North +Main Division

Table 8A. MeHg concentrations (ng L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	0.44		0.32					0.2	
RR12	0.49		0.21					0.22	
RR7	0.32	0.43	0.32		0.1	0.12	0.13	0.21	0.23

Table 8B. MeHg concentrations (ng L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					0.14			
RR12					0.15			
RR7	0.13	0.14			0.11			

Table 8C. THg concentrations (ng L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	3.64		3.5		1.65			2.71	
RR12	3.26		2.48		1.63			2.66	
RR7	2.72	2.51	0.96		1.11	0.76	1.71	2.77	2.44

Table 8D. THg concentrations (ng L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					1.82			
RR12					1.88			
RR7	1.14	3.08			1.61			

Table 8E. Percentage of THg as MeHg for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	12.1		9.1					7.4	
RR12	15		8.5					8.3	
RR7	11.8	17.1	33.3		9	15.8	7.6	7.6	9.4

Table 8F. Percentage of THg as MeHg for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					7.7			
RR12					8			
RR7	11.4	4.5			6.8			

Table 8G. Sulphate concentrations (mg L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	17.8		16.7		16.4			21.3	
RR12	18.8		16.5		14.9			21.2	
RR7	17.2	18.9	16.5		15.7	16.1	21.3	16.9	20.4

Table 8H. Sulphate concentrations (mg L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					15			
RR12					12			
RR7	18	10			16			

Table 8I. Total phosphorus concentrations (μg L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	67		57		59			44	
RR12	70		57		65			42	
RR7	62	50	59		26	24	15	11	28

Table 8J. Total phosphorus concentrations (μg L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					17			
RR12					19			
RR7	28	57			17			

Table 8K. Nitrate concentrations (μg L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	939		4		10			969	
RR12	1029		20		6			1073	
RR7	58	294	68		4	9	206	159	656

Table 8L. Nitrate concentrations (μg L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					127			
RR12					218			
RR7	467	498			276			

Table 8M. Ammonia concentrations (μg L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	65		7		27			20	
RR12	100		43		7			21	
RR7	79	10	29		14	7	20	11	24

Table 8N. Ammonia concentrations (μg L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					9			
RR12					7			
RR7	32	110			6			

Table 8O. DOC concentrations (ppm) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	20		20		23			14	
RR12	17		20		20			13	
RR7	16	18	19		16	17	13	16	9

Table 8P. DOC concentrations (ppm) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					13			
RR12					13			
RR7	11	7			13			

Table 8Q. DIC concentrations (ppm) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	41		47		46			39	
RR12	42		49		46			39	
RR7	41	41	48		48	49	45	42	38

Table 8R. DIC concentrations (ppm) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					38			
RR12					38			
RR7	39	24			38			

Table 8S. Specific conductivity readings (μS cm^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	479		488		480			432	
RR12	492		483		468.5			441	
RR7	473	488	484		493	447.5	502	476	

Table 8T. Specific conductivity readings (μS cm^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					413			
RR12					420			
RR7	439	282		401	425			

Table 8U. Dissolved oxygen concentrations (mg L^{-1}) for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	6.66		5.92		4.94			11.5	
RR12	6.3		5.22		4.76			13	
RR7	5.75	8.08	6.96		4.82	6.79	7.75	9.7	

Table 8V. Dissolved oxygen concentrations (mg L^{-1}) for the North +Main Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR13					9.26			
RR12					9.36			
RR7	13.59	11.54		10.48	9.3			

Table 8W. Percentage of oxygen saturation for the North +Main Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR13	73		70		60			94	
RR12	68		61		55			108	
RR7	70	96	85		57	75	79	80	

Table 8X. Percentage of oxygen saturation for the North +Main Division from February to June 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06
RR13					90		
RR12					90		
RR7	94	79		96	88		

Composite Division

Table 9A. MeHg concentrations (ng L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	0.28		0.22		0.24	0.14	0.18	0.21	0.21

Table 9B. MeHg concentrations (ng L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		0.14	0.15		0.18	0.21	0.2	

Table 9C. THg concentrations (ng L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	1.26		0.8		1.12	0.65	1.09	1.98	2.39

Table 9D. THg concentrations (ng L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		2.62	1.52		1.43	2.7	2.02	

Table 9E. Percentage of THg as MeHg for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	22.2		27.5		21.4	21.5	16.5	10.6	8.8

Table 9F. Percentage of THg as MeHg for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		5.3	9.9		12.6	7.8	9.9	

Table 9G. Sulphate concentrations (mg L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	20.1		18.1		14.1	19.7	20.2	15.3	14.3

Table 9H. Sulphate concentrations (mg L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		12	17		9	8	16	

Table 9I. Total phosphorus concentrations (μg L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	74		136		117	95	25	17	28

Table 9J. Total phosphorus concentrations (μg L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		71	18		20	22	32	

Table 9K. Nitrate concentrations (μg L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	217		21		13	32	449	844	1071

Table 9L. Nitrate concentrations (μg L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		767	519		282	1077	636	

Table 9M. Ammonia concentrations (μg L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	98		33		13	31	67	19	20

Table 9N. Ammonia concentrations (μg L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		141	27		16	19	87	

Table 9O. DOC concentrations (ppm) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	14		16		13	14	14	15	9

Table 9P. DOC concentrations (ppm) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		6	9		11	14	13	

Table 9Q. DIC concentrations (ppm) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	41		48		45	45	46	44	39

Table 9R. DIC concentrations (ppm) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		24	38		39	39	50	

Table 9S. Specific conductivity readings (μS cm^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	518		521		525	487	579	504	470

Table 9T. Specific conductivity readings (μS cm^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		300		424	457	397	511	

Table 9U. Dissolved oxygen concentrations (mg L^{-1}) for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	4.00		6.75		3.15	5.02	5.77	9.20	12.17

Table 9V. Dissolved oxygen concentrations (mg L^{-1}) for the Composite Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR6		10.72		11.40	10.70	10.52	7.08	

Table 9W. Percentage of oxygen saturation for the Composite Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR6	47		82		36	56	59	76	91

Table 9X. Percentage of oxygen saturation for the Composite Division from February to June 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06
RR6		73		106	104	98	80

South Division

Table 10A. MeHg concentrations (ng L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	0.48		0.11		0.17			0.27	
RR2	0.24	0.24	0.13		0.20	0.09	0.11	0.19	0.25
RR3	0.54		0.12		0.17			0.12	
RR4	0.26		0.11		0.18			0.14	0.21
RR5	0.22	0.24	0.12	0.15	0.15	0.09	0.13	0.18	0.27

Table 10B. MeHg concentrations (ng L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					0.03	0.11	0.18	
RR2		0.12	0.09	0.07	0.04			0.66
RR3		0.16			0.04			
RR4					0.03			
RR5	0.14	0.13	0.13	0.07	0.03	0.19	0.17	0.55

Table 10C. THg concentrations (ng L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	1.71		0.00		6.67			1.42	
RR2	3.82	1.17	0.21		0.83	0.49	1.40	1.72	1.43
RR3	7.57		0.26		0.74			2.05	
RR4	3.83		0.21		1.01			2.86	2.94
RR5	1.95	1.17	0.51	0.24	1.18	0.73	1.03	2.12	3.54

Table 10D. THg concentrations (ng L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					0.72	0.78	1.83	
RR2		1.25	0.76	0.80	0.90			2.26
RR3		2.32			3.16			
RR4					0.54			
RR5	1.38	2.93	1.12	1.06	1.52	0.92	1.67	2.96

Table 10E. Percentage of THg as MeHg for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	28.1				2.5			19	
RR2	6.3	20.5	61.9		24.1	18.4	7.9	11	17.5
RR3	7.1		46.2		23			5.9	
RR4	6.8		52.4		17.8			4.9	7.1
RR5	11.3	20.5	23.5	62.5	12.7	12.3	12.6	8.5	7.6

Table 10F. Percentage of THg as MeHg for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					4.2	14.1	9.8	
RR2		9.6	11.8	8.8	4.4			29.2
RR3		6.9			1.3			
RR4					5.6			
RR5	10.1	4.4	11.6	6.6	2	20.7	10.2	18.6

Table 10G. Sulphate concentrations (mg L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	21.2		18		20			21	
RR2	1.2	19.2	11		7	13.9	6	21	13
RR3	14.9		11		7			21	
RR4	20.6		17		4			16	11.4
RR5	21	21.1	21	13	15	14.1	7	21	12

Table 10H. Sulphate concentrations (mg L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					14	10	8	
RR2		4	18	16	17			15
RR3		16			16			
RR4					18			
RR5	18	14	16	18	18	17	16	17

Table 10I. Total phosphorus concentrations (μg L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	162		13		160			13	
RR2	90	42	19		38	17	28	16	11
RR3	133		12		23			14	
RR4	112		47		47			28	58
RR5	97	52	39	7	45	26	15	47	39

Table 10J. Total phosphorus concentrations (μg L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					18	18	27	
RR2		20	22	36	71			44
RR3		50			15			
RR4					20			
RR5	22	67	20	23	19	24	33	64

Table 10K. Nitrate concentrations (μg L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	23		89		158			387	
RR2	159	30	13		18	15	173	125	165
RR3	449		11		104			379	
RR4	2575		158		23			1248	869
RR5	315	286	16	2	11	0	679	883	1755

Table 10L. Nitrate concentrations (μg L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					0	50	40	
RR2		79	54	5	5			43
RR3		272			72			
RR4					231			
RR5	416	600	548	309	228	1238	735	746

Table 10M. Ammonia concentrations (μg L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	263		11		205			19	
RR2	68	31	17		26	13	14	20	4
RR3	50		22		35			5	
RR4	171		44		49			5	29
RR5	139	30	19	14	18	4	26	17	23

Table 10N. Ammonia concentrations (μg L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					0	5	25	
RR2		22	18	5	2			61
RR3		25			5			
RR4					4			
RR5	36	105	41	10	13	20	33	64

Table 10O. DOC concentrations (ppm) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	10		3		3			7	
RR2	9	8	6		4	6	8	9	6
RR3	10		6		5			8	
RR4	9		5		6			6	6
RR5	10	8	7	7	6	7	7	8	5

Table 10P. DOC concentrations (ppm) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					5	9	11	
RR2		4	4	6	6			13
RR3		4			6			
RR4					5			
RR5	5	4	4	6	6	7	8	12

Table 10Q. DIC concentrations (ppm) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1	51		26		28			59	
RR2	33	43	40		35	32	54	45	40
RR3	27		43		42			45	
RR4	38		46		46			45	37
RR5	36	47	47	43	46	46	52	47	41

Table 10R. DIC concentrations (ppm) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					53	49	61	
RR2		33	47	52	51			51
RR3		32			52			
RR4					53			
RR5	48	27	44	47	44	48	52	42

Table 10S. Specific conductivity readings ($\mu S\ cm^{-1}$) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1			350		363			786	
RR2	466	564	513		482	378	812	547	479
RR3	454		583		560			560	
RR4	591		690		668			582	523
RR5	565	642	629	636	633	569	706	594	517

Table 10T. Specific conductivity readings (μS cm^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					607	577	650	
RR2		500		617	437			
RR3		504						
RR4					413			
RR5	667	392		568	583	555	646	

Table 10U. Dissolved oxygen concentrations (mg L^{-1}) for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1			11.20		7.35			7.55	
RR2	1.35	7.75	11.85		6.77	9.20	9.65	8.60	11.34
RR3	5.25		7.17		9.97			9.07	
RR4	5.45		5.50		6.70			9.30	10.15
RR5	5.40	4.64	4.75	5.50	4.33	5.93	8.10	8.70	10.37

Table 10V. Dissolved oxygen concentrations (mg L^{-1}) for the South Division from February to August 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06	Aug. 4/06
RR1					10.50	11.84	9.67	
RR2		11.09		11.85	10.76			
RR3		10.56						
RR4					11.58			
RR5	12.70	10.98		11.30	10.63	10.35	6.33	

Table 10W. Percentage of oxygen saturation for the South Division from June to November 2005.

	June 14/05	June 29/05	July 14/05	July 26/05	Aug. 11/05	Aug. 23/05	Sept. 28/05	Oct. 26/05	Nov. 30/05
RR1			135		87			65	
RR2	14	90	145		80	102	100	72	89
RR3	58		85		115			76	
RR4	60		65		71			79	81
RR5	61	56	55	65	48	63	80	73	81

Table 10X. Percentage of oxygen saturation for the South Division from February to June 2006.

	Feb. 2/06	Mar. 15/06	Mar. 23/06	Apr. 19/06	May 2/06	May 24/06	June 19/06
RR1					102	113	110
RR2		76		122	94		
RR3		72					
RR4					105		
RR5	87	74		106	98	95	85

Data of the Peatland Sampling Sites

Table 11A. MeHg concentrations (ng L^{-1}) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	0.31		0.44	0.14	0.13		0.26	
Newington Bog A	1.13		1.06	0.8	0.2	0.86	0.26	2.29
Newington Bog B	1.11		0.66	0.22	0.21	0.47	0.2	1.04
Newington Bog C	0.9							
Newington Bog D			0.96					
Newington Bog E				0.58	0.21			
Monkland Drain A		0.43	0.31	0.11	0.1	0.2	0.2	0.24
Monkland Drain B		0.44		0.21	0.15	0.5	0.26	0.62

Table 11B. THg concentrations (ng L^{-1}) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	3.87		2.05	3.35	3.9		4.83	
Newington Bog A	8.29		3.43	5.68	7.86	4.06	5.21	5.88
Newington Bog B	5.19		3.77	9.38	7.51	5.04	5.48	5.36
Newington Bog C	4.99							
Newington Bog D			3.78					
Newington Bog E				5.11	5.97			
Monkland Drain A		1.86	0.95	1.18	174.07	0.79	2.3	1.23
Monkland Drain B		4.93		2.37	1.81	1.36	5.64	2.38

Table 11C. Percentage of THg as MeHg for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	8.01		21.46	4.18	3.33		5.38	
Newington Bog A	13.63		30.9	14.09	2.55	21.18	4.99	38.95
Newington Bog B	21.39		17.51	2.34	2.8	9.33	3.65	19.4
Newington Bog C	18.04							
Newington Bog D			25.4					
Newington Bog E				11.35	3.52			
Monkland Drain A		23.12	32.63	9.31	0.06	25.32	8.7	19.51
Monkland Drain B		8.92		8.85	8.3	36.76	4.61	26.05

Table 11D. Ammonia concentrations (μg L^{-1}) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	47		5	23	26		18	
Newington Bog A	82		422	536	655	948	305	1079
Newington Bog B	106		55	27	44	120	22	27
Newington Bog C	269							
Newington Bog D			396					
Newington Bog E				619	435			
Monkland Drain A		29	74	3	0	84	4	16
Monkland Drain B		3		14	8	75	26	50

Table 11E. Nitrate concentrations (μg L^{-1}) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	74		82	555	369		645	
Newington Bog A	0		0	19	24	28	53	11
Newington Bog B	7		25	88	204	104	215	15
Newington Bog C	14							
Newington Bog D			0					
Newington Bog E				13	61			
Monkland Drain A		4	3	25	699	93	534	2
Monkland Drain B		41		318	254	109	288	31

Table 11F. Sulphate concentrations (mg L^{-1}) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	15		15	14	11		10	
Newington Bog A	9		9	17	16	17	15	19
Newington Bog B	17		18	18	15	14	10	19
Newington Bog C	18							
Newington Bog D			9					
Newington Bog E				17	17			
Monkland Drain A		9	8	16	8	6	8	8
Monkland Drain B		12		14	6	8	7	11

Table 11G. Total phosphorus concentrations (μg L^{-1}) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	10		18	8	43		2	
Newington Bog A	14		45	16	0	3	7	13
Newington Bog B	16		6	1	0	0	2	1
Newington Bog C	20							
Newington Bog D			49					
Newington Bog E				15	5			
Monkland Drain A		19	40	31	22	0	6	0
Monkland Drain B		39		6	10	0	23	12

Table 11H. DOC concentrations (ppm) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	31		33	33	29		15	
Newington Bog A	55		61	55	36	37	23	35
Newington Bog B	40		47	45	35	30	17	32
Newington Bog C	41							
Newington Bog D			62					
Newington Bog E				52	37			
Monkland Drain A		26	26	18	14	14	10	18
Monkland Drain B		31		21	17	15	10	21

Table 11I. DIC concentrations (ppm) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	21		24	15	11		13	
Newington Bog A	0		2	2	1	4	2	4
Newington Bog B	23		20	15	13	14	13	19
Newington Bog C	22							
Newington Bog D			3					
Newington Bog E				3	2			
Monkland Drain A		51	44	39	35	46	24	38
Monkland Drain B		38		33	28	34	23	32

Table 11J. Specific conductivity measurements ($\mu S\ cm^{-1}$) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	192		226	95	95		100.8	
Newington Bog A	39		54	30	44	42	34.5	48
Newington Bog B	267		219	95	111.4	109	79.5	238
Newington Bog C	2720							
Newington Bog D			58					
Newington Bog E				48	41.4			
Monkland Drain A		505	431	382	292	370	187.8	392
Monkland Drain B		334		270	199	230	152.8	137

Table 11K. Dissolved oxygen concentrations ($mg\ L^{-1}$) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	8.3		6.6	6.7			11.2	
Newington Bog A	4.2		2.8	1.9		7	11.5	3.9
Newington Bog B	3.25		4.2	6.7		11	11	7.4
Newington Bog C	3.6			4.1				
Newington Bog D			3.6					
Newington Bog E								
Monkland Drain A		5.5	5.5	8		10.6	12	4.2
Monkland Drain B		7.1		7.5		10.6	12	7.4

Table 11L. Temperature (°C) for the Peatland Sites.

	21-Jun-06	06-Jul-06	10-Oct-06	10-Nov-06	05-Dec-06	24-Jan-07	28-Mar-07	10-May-07
RR 21	19		12.2	6.8	0.6		0	
Newington Bog A	23.2		12.8	8	0	1.8	1	8.5
Newington Bog B	21		11.2	6.8	0.7	0.5	0	14
Newington Bog C	21.5							
Newington Bog D			12.2					
Newington Bog E				7.2	0			
Monkland Drain A		18	11.2	6.8	0	1.2	0	12.5
Monkland Drain B		21.2		6.8	0	0.2	0	14.8

Sample of Yield Calculation:

Site: RR22
MeHg

Concentration (ng/L)	Precipitation (40%)	Month	Area of site (m squared)	=conc.*precip/area (ng m^{-2} $month^{-1}$)
0.52	55.6	June	25130000	1.1505E-06
0.75	29.12	July	25130000	8.69081E-07
0.43	55.16	August	25130000	9.43844E-07
0.3	44.04	September	25130000	5.25746E-07
0.25	87.32	October	25130000	8.68683E-07
0.32	40.4	November	25130000	5.14445E-07
0.19	31.32	February	25130000	2.36801E-07
0.145	5.32	March	25130000	3.06964E-08
0.18	27.36	April	25130000	1.95973E-07
0.09	41.8	May	25130000	1.49702E-07
0.29	39.48	June	25130000	4.55599E-07
0.72	40	August	25130000	1.14604E-06
			Sum:	7.08711E-06
			Average:	5.90592E-07